TEKNILLINEN TIEDEKUNTA

STAKEHOLDER ORGANIZATION MODEL FOR COLLABORATIVE INDUSTRIAL INVESTMENT PROJECTS

Tommi Pauna

INDUSTRIAL ENGINEERING AND MANAGEMENT

Master's Thesis

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ABSTRACT
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Abstract

Industrial investment projects are carried out in complex networks of different organizations. Therefore, resources and competencies from different organizations have to be integrated to the project. Success statistics of large investment projects are quite weak when they are evaluated with traditional quality, cost and time indicators. Especially management of complex networks and integration of different stakeholders cause challenges. In the literature, it has been noted that team integration, collaboration and better management of inter-organizational integration can improve project performance. In industrial investment project context, there is a lack of knowledge about which stakeholders should be involved in collaboration and how deeply and in which project phases.

The purpose of the study is to construct a model that defines different levels of collaboration and supports in organizing stakeholders on these levels. In addition, the model should define that how deeply different levels are involved and what collaborative methods and tools they use. In the beginning of the research, literature related to inter-organizational integration, stakeholder management and level of collaboration are presented. Empirical research was conducted by observations in the case project and in a workshop that was arranged for industrial experts.

In complex projects with a lot of uncertainty and equivocality, important stakeholders should be involved early in the project. Early involvement, socialization, joint discussions and mutual collaboration can support the achievement of goals and help improve project performance. Stakeholders' importance can be defined according to their roles and responsibilities in the project, their competencies, information and interests related to the project and the level they can affect the project. Important stakeholders of the case project had a central role in the project and they had competencies that were useful for the project design and scheduling. According to the literature review and empirical analysis, the stakeholder organization model is constructed and its use defined.

Stakeholder organization model includes five phases:

- Defining the project objectives and overall need for collaboration
- Stakeholder identification
- Evaluation of stakeholder importance
- Stakeholder organization on different levels of collaboration
- Defining appropriate integration mechanisms and collaborative methods and tools for each level

There were no guidelines for organizing stakeholders on different levels in industrial investment project context. The model of this study can be used for defining need for collaboration and important stakeholders, organizing stakeholders on different levels and definition of which collaborative methods and tools could be introduced in the project and how different levels should use them. The results can be utilized in collaborative investment projects but utility of the model should be validated in different industrial projects. Stakeholder levels and requirements for the use of collaborative methods and tools should be tested and adjusted if needed.

Additional Information

Key words: industrial investment project, collaborative project, stakeholder involvement, collaborative methods and tools

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Tiivistelmä

Teolliset investointiprojektit toteutetaan erilaisten organisaatioiden verkostoissa. Siksi resursseja ja kompetensseja erilaisilta organisaatioilta tulee integroida mukaan projektiin. Suurten investointiprojektien onnistumistilastot ovat melko heikkoja, kun niitä arvioidaan perinteisillä laatu-, kustannus- ja aikaindikaattoreilla. Erityisesti kompleksisten verkostojen hallinta ja erilaisten sidosryhmien integrointi aiheuttavat haasteita. Kirjallisuudessa on huomattu, että tiimin integraatio, yhteistoiminnallisuus ja parempi organisaatioiden välisen integraation hallinta voivat parantaa suorituskykyä. Teollisten investointiprojektien tapauksessa ei tiedetä, mitkä sidosryhmät tulisi osallistaa yhteistoimintaan, kuinka tiiviisti ja missä projektin vaiheissa.

Tämän tutkimuksen tarkoitus on konstruoida malli, joka määrittää erilaiset yhteistoiminnallisuuden tasot ja tukee sidosryhmien organisointia näille tasoille. Lisäksi mallin avulla voidaan määritellä kuinka tiiviisti erilaiset tasot osallistuvat ja mitä yhteistoiminnallisia menetelmiä ja työkaluja ne käyttävät. Tutkimuksen aluksi esitellään kirjallisuutta organisaatioiden väliseen integraatioon, sidosryhmien johtamiseen ja yhteistoiminnallisuuden tasoihin liittyen. Empiirinen tutkimus suoritettiin havainnointitutkimuksena case-projektissa ja työpajana, joka järjestettiin teollisuuden asiantuntijoille.

Kompleksisissa projekteissa, joissa on paljon epävarmuutta ja tulkinnanvaraisuutta, tärkeät sidosryhmät tulisi osallistaa projektiin varhaisessa vaiheessa. Varhainen osallistaminen, sosialisointi, yhteiset keskustelut ja keskinäinen yhteistoiminta voivat tukea tavoitteiden saavuttamista ja auttaa parantamaan projektin suorituskykyä. Sidosryhmien tärkeys voidaan määritellä, niiden roolien ja vastuiden, projektiin liittyvien kompetenssien, informaation ja kiinnostuksen ja sen kuinka paljon ne voivat vaikuttaa projektiin, perusteella. Case-projektin tärkeillä sidosryhmillä oli keskeinen rooli projektissa ja kokemusta ja osaamista, jotka olivat hyödyllisiä projektin suunnitteluun ja aikataulutukseen. Sidosryhmien organisointimalli on konstruoitu ja sen käyttö määritelty kirjallisuuskatsauksen ja empiirisen analyysin perusteella.

Sidosryhmien organisointimalli sisältää viisi vaihetta:

- Määritellään projektin tavoitteet ja yhteistoiminnallisuuden kokonaistarve
- Tunnistetaan sidosryhmät
- Arvioidaan sidosryhmien tärkeys
- Organisoidaan sidosryhmät erilaisille yhteistoiminnallisuuden tasoille
- Määritellään sopivat integraatiomekanismit ja yhteistoiminnalliset menetelmät ja työkalut jokaiselle tasolle

Teollisille investointiprojekteille ei ollut olemassa ohjeita siitä, miten sidosryhmät tulisi organisoida erilaisille tasoille. Tämän tutkimuksen mallia voidaan käyttää määriteltäessä yhteistoiminnallisuuden tarvetta ja tärkeitä sidosryhmiä, sidosryhmien organisoinnissa eri tasoille ja määrittelyssä siitä mitä yhteistoiminnallisia menetelmiä ja työkaluja voitaisiin ottaa käyttöön projektissa ja kuinka erilaisten tasojen tulisi käyttää niitä. Tutkimustuloksia voidaan käyttää yhteistoiminnallisissa investointiprojekteissa mutta mallin käytettävyys tulisi validoida erilaisissa investointiprojekteissa. Sidosryhmien tasot ja yhteistoiminnallisten menetelmien ja työkalujen käytön vaatimukset pitäisi testata ja hienosäätää tarvittaessa.

Muita tietoja
Avainsanat: teollinen investointiprojekti, yhteistoiminnallinen projekti, sidosryhmien osallistaminen, yhteistoiminnalliset menetelmät ja työkalut

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In Oulu, 24.6.2019 Tommi Pauna

CONTENTS

1 INTRODUCTION

1.1 Background

Investment project is a long-term allocation of resources aiming to implement an investment idea with the objective of future profits. Large multinational investment projects are increasingly implemented in complex networks of different organizations and resources and competencies from multiple companies and units inside companies have to be integrated to the project (Aaltonen et al. 2010). Performance and success statistics of large multinational investment projects are quite weak if the evaluation is done by traditional indicators quality, time and cost (Flyvbjerg et al. 2003). Problems occur for example because collaboration and its governance between different project actors in complex project networks is challenging (Chakkol et al. 2018). In management of complex projects, one significant challenge is ensuring that the right person has the right knowledge at the right time (Majava et al. 2019). In complex projects, the management of inter-organizational integration is challenging and integration requirements change over project life cycle and between projects (Hietajärvi et al. 2017a). Zhai et al. (2009) noted that in megaprojects, similar to large industrial investment projects, the quality of project management creates significant value for different stakeholders.

In investment projects, there are usually needs to build something so challenges in the construction industry should be noticed also. The challenges in the construction and infrastructure projects which constantly lead to problems like cost overruns, disputes, delays, and low productivity, have raised awareness of developing project delivery models and project management practices (e.g. Baiden et al. 2006; Aapaoja et al. 2012). These problems in the construction industry arise from factors like low-bid syndrome, traditional approaches (e.g. design-bid-build) focusing to “risk transfer”, sub-optimization of stakeholder’s own work and lack of trust and collaboration (Chen et al. 2012; Lahdenperä 2012). Integrated project delivery (IPD), team integration and collaboration and management of inter-organizational integration are suggested to help solving the above-mentioned problems (Aapaoja et al. 2013c; Hietajärvi et al. 2017a).

Collaborative project arrangements have been developed to manage especially complex construction projects, which have suffered from fragmented construction process.

Collaborative project arrangements can be divided into three approaches: integrated project delivery (IPD), project alliancing (PA) and project partnering (PP). These approaches have similar features but also some differences. However, all three approaches aim to decrease fragmentation and to increase integration and collaboration. (Lahdenperä 2012) For the sake of clarity, in this study the term IPD is used to cover all the collaborative project arrangements. A collaborative project environment requires that stakeholders from different organizations work together toward common goals and mutual benefits as an integrated team (Aapaoja et al. 2013c).

Inter-organizational integration in project environment means connecting different organizations or parts of these organizations together to enable working in collaboration. In the multinational investment projects, inter-organizational integration helps to improve the pursuit of common project goals and objectives (Pekkinen & Kujala 2014). Inter-organizational integration is an important organizational capability and it offers significant opportunities to develop organizational operations (Mitropoulos & Tatum 2000). The process of inter-organizational integration is a compound of many factors and managing it can be handled by exploitation of organizational and relational arrangements (Ibrahim et al. 2013a; Hietajärvi et al. 2017a). Inter-organizational integration is used to improve the performance of the project but not all integration is beneficial or needed because integration mechanisms affect costs. Different projects require different levels of inter-organizational integration and when the projects proceed the need for integration probably decreases. Therefore, the amount of inter-organizational integration and use of integration mechanisms should be tailored to every project and management of it should change within the project life cycle. (Hietajärvi et al. 2017a)

It is important and beneficial to involve and integrate stakeholders' early (Aapaoja et al. 2013a) and it can be done by use of different integration mechanisms (Hietajärvi et al. 2017a). For example, Big Room is an integration mechanism that supports collaboration of project parties. Its purpose is to convert traditional meetings focusing on information conveying to the more interactive information sharing and problem solving. (Khanzode & Senescu 2012) Collaborative practices have been extensively studied in construction industry but not with the same extent in the industrial investment project context. In addition, it has been noted that there are various challenges in implementation of collaborative practices in industrial investment projects (Van Marrewijk et al. 2016).

For example, there is a lack of knowledge about how to decide which stakeholders are involved in the collaboration and when to enhance project performance (Chakkol et al. 2018). It would be beneficial to have a method to define in which phase of the project different stakeholders should be involved, how comprehensively different stakeholder groups should be involved and what the requirements of different stakeholders should be.

1.2 Research objectives

The purpose of this study is to construct a model that can be used to organize project stakeholders on different levels of participation to collaboration in industrial investment projects. The model should define what are the different levels, how stakeholders can be identified, evaluated and organized into these levels, how different levels are involved and what collaborative methods and tools to use at different levels regarding the participation in Big Room for example. It is important to understand the collaboration from the system point of view in multi-stakeholder network and not to focus on how likely the claims from individual stakeholders are taken into account by project management (e.g. Mitchell et al. 1997) or how individual stakeholders affect the organization's achievement of the objectives (e.g. Freeman 1984). Therefore, in this study, stakeholders refer to the groups or individuals who can affect or are affected by "*the approach to the issue addressed by the network*" (Roloff 2008, p. 238). In addition, the term stakeholder refers to internal stakeholders of the project for example owners, customers and suppliers who are directly involved in the decision-making processes (Atkin & Skitmore 2008) and the model is meant to be used to manage them and their relationships.

Stakeholders have different kinds of interests and responsibilities in the projects and their importance varies. It is problematic if stakeholders that are lacking interests and ability to make an impact are involved too heavily and they are for example required to take part of the Big Room unduly. On the other hand, important and powerful stakeholders, which can and want to make an impact should be noticed and involved. Thus, stakeholders should be organized at different levels and different levels should be involved differently and have diverged requirements for participation and use of collaborative tools. It is not reasonable to involve every stakeholder in every

collaborative activity with similar responsibilities and some stakeholders should not be involved at all.

To be able to construct a model it has to be defined with the help of literature review what is the inter-organizational integration, how to define and analyze stakeholder importance and what kind of different levels of collaboration in IPD there are. The first purpose of the empirical research is to identify the needs for stakeholder involvement and collaboration and to find how the collaboration is actually conducted. Then, empirical analysis aims to identify important stakeholders that were involved and to find means to organize stakeholders on the different levels of the collaboration. As a constructive research, the final target is to provide the model and to define how and by which criteria stakeholders can be organized on the different levels and which collaborative tools and methods different levels use. Three research questions are set to guide the research to the right direction. Next, the research questions are presented with short descriptions about the objectives:

RQ1. How to define stakeholder importance and different levels of collaboration in IPD?

The objective is to define the key elements, which make stakeholders important from the point of view of participation to collaboration and to provide tools for organizing the project stakeholders on different levels and defining the right level of collaboration for them. Prior studies have been researched to gain understanding about inter-organizational integration as a phenomenon, to find tools and methods for stakeholder organization and to define what collaboration is and how it can be achieved. The final aim is to form the understanding of how collaboration can be achieved, which factors are important to notice when stakeholders are involved in the collaboration, how to define stakeholder importance and which can be the different levels of the stakeholders' involvement in the collaboration.

RQ2. Which stakeholders were important and involved?

The objectives are to find what the reasons for stakeholder involvement and collaboration are, how the stakeholder involvement should vary between different projects and different project phases and which stakeholders were important and involved in the collaboration in the case project. Aim is to identify factors that make

stakeholder involvement valuable and to note how stakeholder involvement should vary in different circumstances. Importance of different stakeholders in the case project and their involvement in the collaboration can be used to form stakeholder identification practices and stakeholder evaluation criteria.

RQ3. How to organize stakeholders on different levels of the model and by which collaborative methods and tools?

This research question is set to define the model. Elements of the model are defined based on the cornerstones identified from the literature and modified based on the empirical results. The model needs elements to support defining the right level of collaboration in the project, identification, evaluation and organization of stakeholders in different levels and defining how stakeholders in different levels participate. The aim is to create an evaluation criteria that can be used to define at which levels of collaboration different stakeholders are and which collaborative methods and tools they should use.

1.3 Research process

This research is a qualitative study and it consists of background study, literature review, collection and analyses of empirical data and formation of the model. The research process started from the background study with the aim to get familiar with inter-organizational integration, collaboration and stakeholder management in the projects. The research objectives and research questions were set after the background study.

The literature review focused to review inter-organizational integration as a phenomenon, different integration mechanisms including collaborative spaces like Big Room, stakeholder management theories, collaboration and different levels of it. The literature highlights the importance of inter-organizational integration and collaboration in megaprojects and it contains methods and tools to manage integration and to manage and involve stakeholders. The focus could have been more in the supplier network theories instead of stakeholder theories but the stakeholder view was chosen because there are already various different stakeholder analysis and stakeholder identification,

classification and prioritization methods and models that are commonly known, practical and can be used to construct the stakeholder organization model.

However, there is not a comprehensive model that would support the stakeholder involvement in collaboration for the industrial investment project context. Empirical research was conducted with an aim to increase understanding of stakeholder involvement and collaboration and to illustrate what the model should include. The data were collected by observation studies in a case project and workshop organized for industrial experts. The gathering of the data was implemented as a part of the research project's scope with other researchers. Based on the literature research and empirical analysis a generic stakeholder organization model is constructed. As a conclusion, key results, theoretical contribution, and managerial implications are presented that aim to help in management of stakeholders in megaprojects from collaboration point of view. In the end, the research is evaluated in terms of its internal and external validity, reliability and objectivity and future research recommendations are provided. Figure 1 presents the research process.

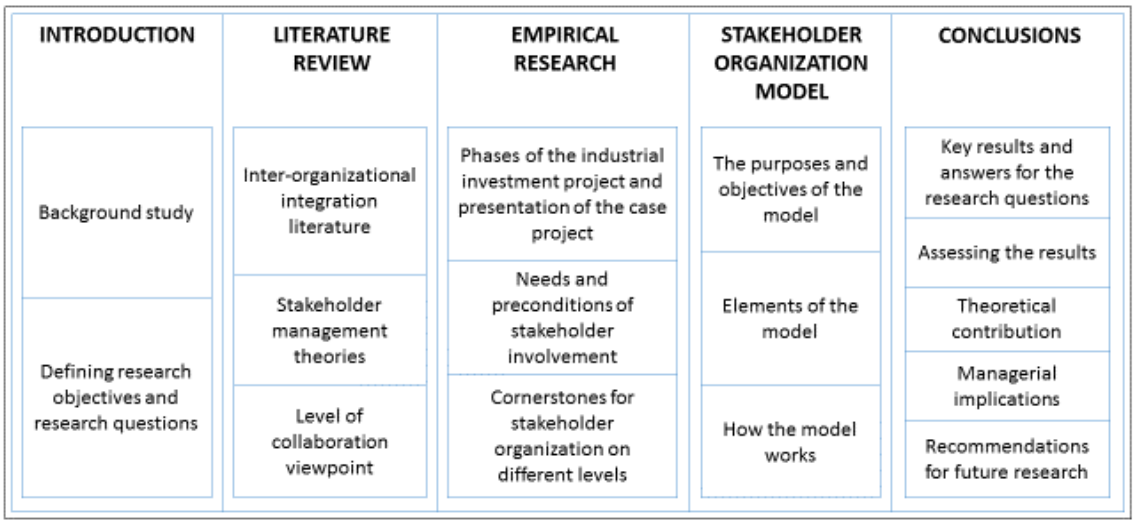

Figure 1. Research process.

2 LITERATURE REVIEW

The literature review contains theories from prior studies about integration, stakeholders and collaboration and it provides a theoretical framework for this research. The prior studies and theories related to integration are reviewed with the aim to understand the inter-organizational integration as a phenomenon and to understand how the use of different integration mechanisms frame the foundation for collaboration. Stakeholder management theories and practices are researched to gather the means for stakeholder analysis and to find cornerstones for stakeholder organization. Literature related to collaboration is reviewed to gather information about preconditions for collaboration and cornerstones for creating an integrated project team and to identify the different involvement levels of stakeholders. Figure 2 illustrates the structure of the literature review.

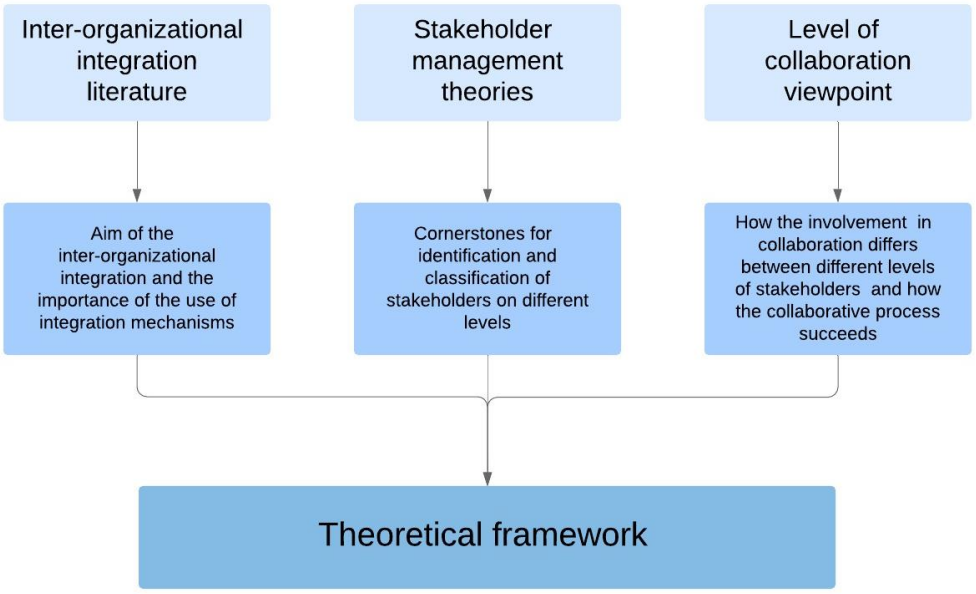

Figure 2. The structure of the literature review.

2.1 Inter-organizational integration

Inter-organizational integration in project environment can be explained to be a process where different organizations or parts of them are linked together to work in collaboration and to reach desirable goals referring usually to project's targets. In the research and practice of management, organizational integration is one of the most

settled concepts (Turkulainen & Ketokivi 2012). In the 1960s and 1970s early integration scholars focused to study how the organizations, systems and projects should be managed (e.g. Lawrence & Lorsch 1967; Galbraith 1974) and the focus was mostly in intra-organizational context but the organizational landscape has become more complex and understanding integration in inter-organizational context is coming more important (Hietajärvi et al. 2017a). Multi-disciplinary and multi-cultural project teams have become more common in construction industry and success of these teams is dependent on how well they can integrate (Ibrahim et al. 2013b).

Inter-organizational integration is stated to be highly important organizational capability and core function of project management that intends to deal with interdependency, change and uncertainty in complex projects (Lawrence & Lorsch 1967; Davies & Mackenzie 2014; Morris, 2013). Lawrence and Lorsch (1967) defined integration to be a process for unifying the efforts of organizational subsystems and Kirsilä et al. (2007) noted that integration is a process where it is ensured that required activities in the project are properly coordinated. Team integration improves the collaboration and it helps the members of the team to understand the big picture of the project (Walker et al. 2017). Inter-organizational integration is important in multinational investment projects because it helps to align the targets of different subprojects and improves the pursuit of common project goals (Pekkinen & Kujala 2014).

It is obvious that when there are more parts to be integrated to the project the role of integration management becomes more important. The need for integration within and between units of organization forms from organizational environmental uncertainty and from the complex and uncertain tasks and task networks (Mitropoulos & Tatum 2000). Mainly the number of tasks and phases of the project and the interactions between them cause the project complexity and this complexity causes uncertainty to the project (Loch et al. 2006, p. 64). For example, Hietajärvi et al. (2017a) noticed that in certain alliance projects complexity of the project and lack of previous collaboration between project participants increased uncertainty and therefore raised the need for higher-level integration. In cross-functional projects that are more complex and demand higher levels of knowledge integration than involved organizations have used to, the creation of common knowledge and socialization are very important (Huang & Newell 2003).

Walker et al. (2017) noted that the ratio between risks and different forms of uncertainty and ambiguity within the contingency budget development differs between traditional project delivery and IPD. In project management, risk refers to an event or a situation whose existence and impact are known but the realization is not known thus, risks are defined to be known knowns and uncertainty is an event or a situation, which was not expected to take place so it is unknown (Perminova et al. 2008; Ward & Chapman 2003). Ambiguity can be divided into situational ambiguity and people and process ambiguity. Situational ambiguity occurs when situation is uncertain and difficult to identify and evaluate, and people and process ambiguity when people face uncertainty but think they are facing a known known and make conclusions with invalid assumptions they have. (Walker et al. 2017) In brief, risk is information that something may happen with known consequences, uncertainty is a lack of information and ambiguity is a lack of clarity (Perminova et al. 2008; Schrader et al. 1993).

The differences in contingency budgets between traditional project delivery and IPD exist mainly due to fact that in traditional project delivery existence of certain levels of uncertainty and ambiguity are allowed and included in the bid based on earlier experiences. On the contrary, IPD enhances the high levels of collaboration and open and intimate communication that can help to reduce uncertainty, to solve situational ambiguity and to enhance the reduction of people and process ambiguity by reducing likelihood of prejudices and restrictive thinking. (Walker et al. 2017) However, when collaboration reduces uncertainty the amounts of known knowns - in other words risks - increase because uncertainty transforms into risks and opportunities (Walker et al. 2017; Perminova et al. 2008).

Large investment projects require integration because of their complex and inter-organizational nature. In large investment projects, there exists a lot of uncertainty, which is seen as a lack of information and equivocality, which is seen as ambiguity and existence of many interpretations that may be conflicting. Integration is seen as a way to reduce them. (Pekkinen & Kujala 2014) Usually, an investment project consists of three main phases: the investment preparation phase, the project execution phase and the operational phase and these different phases have different integration needs. In general, the need for integration decreases as the project progresses and increases if an unexpected event happens (Hietajärvi et al. 2017a). For example, in a preparation phase collaborative meeting which can be considered as a tool for integration can be very

effective because in this point there exists many different and maybe conflicting opinions (Pekkinen & Kujala 2014).

2.1.1 Integration mechanisms

Tools used to increase and control integration in the organizations are called integration mechanisms, and one of their goals is to decrease uncertainty and ambiguity the organizations face. From intra-organizational point of view function of the integration mechanisms is to link together different parts of the organization to execute a mutual set of tasks (Van de Ven et al. 1976). Different organizations use different types of integration mechanisms that are appropriate to the situation and to the organization (Turkulainen et al. 2015). Integration mechanisms are able to manage both internal and external sources of uncertainty (Mitropoulos & Tatum 2000). They can be used to deal with situations where unexpected and emergent events happen (Hietajärvi & Aaltonen 2018). Organizations that are effective in integration management always adjust their integration mechanisms with current requirements and needs so that integration's input output ratio is optimal (Lawrence & Lorsch 1967).

Integration mechanisms contain both formal and informal mechanisms. Formal integration mechanisms refer to official and contractual issues that can be agreed and "engineered". They include for example contracts, standard documentation, tools, techniques, teambuilding workshops, and the use of facilitators, official rules and incentives. (Mitropoulos & Tatum 2000; Bresnen & Marshall 2002; Turkulainen et al. 2015) Informal integration mechanisms are related to development of informal relations and organizational structures for example by teaming outside the office, creating communication guidelines and setting common rules and values (Mitropoulos & Tatum 2000; Aaltonen & Turkulainen 2018). Both formal and informal mechanisms support the facilitation of information and knowledge sharing (Lawson et al. 2009; Turkulainen et al. 2015).

According to Bresnen and Marshall (2002), collaborative project arrangements stress the importance of formal integration mechanisms in inculcation of collaborative values and norms. However, both formal and informal mechanisms are needed in successful collaboration (Bresnen & Marshall 2002). The informal integration mechanisms have great positive significance on the development phase of the projects because they help to create the high levels of relational capital which supports the success of the project in

later phases (Aaltonen & Turkulainen 2018). When good informal relationships exist in the early stages of the project, it helps to create high levels of mutual trust and decrease opposing attitudes (Baiden et al. 2006). Mutual respect and trust can be built also with coordination of communication between team members, open discussions, shared team confidence based on the individual team members' capabilities and transparency, openness and honesty between all members (Ghassemi & Becerik-Gerber 2011).

The literature contains many classifications of the integration mechanisms (e.g. Van de Ven et al. 1967; Galbraith 1973; Mitropoulos & Tatum 2000). Turkulainen et al. (2015) adapted classifications from Galbraith (1973) and Van de Ven et al. (1976) and divided integration mechanisms into three modes:

- **Impersonal**
- **Personal**
- **Group**

Impersonal mode is characterized by pre-established action plan that minimizes human decision-making and verbal communication (Galbraith 1973). It includes different rules, descriptions, manuals, schedules, formal plans and standardized communication system (Van de Ven et al. 1976; Turkulainen et al. 2015). On the contrary, personal and group mode are based on mutual adjustment (Turkulainen et al. 2015). Personal mode includes co-operation and integration roles in different communication channels so the individuals themselves act as mechanisms for integration (Lawrence & Lorsch 1967; Tushman 1977). In group mode, mutual adjustment is made in meetings, committees and teams by groups of people meaning for example cross-unit teams, integrative departments and ad-hoc teams (Van de Ven et al. 1976; Turkulainen et al. 2015).

Mitropoulos and Tatum (2000) presented a widely known depiction of integration implementation and management where integration mechanisms were divided into three categories:

- **Contractual**
- **Organizational**
- **Technological**

Contractual mechanisms are primarily formal mechanisms including different incentives, practices, common goals, plans and rules that are agreed to abide. Contractual mechanisms are inter-organizational and they aim to integrate different parties together. (Mitropoulos & Tatum 2000) In integrated project deliveries, contractual integration may include for example incentives, shared risks and rewards and jointly developed and validated goals and targets (Cohen 2010). For example, in alliance projects, transparency and contractual incentives can help to achieve better team working quality and relational attitudes, which improve the project performance (Aapaoja et al. 2013b; Suprapto et al. 2016). In addition, incentives encourage the effective management of risks (Walker et al. 2017). When risks and rewards are shared, stakeholders implement collaborative mechanisms at more intense levels and decisions are more likely to be done with "best for the project attitude" (Chen et al. 2018). Common vision and shared objectives are one of the most important components of owner-contractor collaboration (Suprapto et al. 2015b).

Organizational mechanisms intend to integrate people and they include different guidelines, structures and informal interaction, which are promoted for example by use of matrix structure, cross-functional teams and working sessions like workshops (Mitropoulos & Tatum 2000). The ultimate goal of organizational mechanisms is to increase mutual collaboration and team effectiveness (Mitropoulos & Tatum 2000; Hietajärvi et al. 2017a). Research on alliance projects has mainly focused on contractual and technical issues and paid less attention on social aspects that are also important in collaborative projects' performance (Ibrahim et al. 2013a; Aaltonen & Turkulainen 2018). Socialization mechanisms closely related to organizational mechanisms can be divided into formal and informal socialization mechanisms. Formal socialization mechanisms include matrix reporting and formal project structures, use of co-locational spaces and cross-functional teams, workshops, joint training and relationship programs. Informal mechanisms include communication guidelines, informal teaming events and other social events for example. (Lawson et al. 2009; Hietajärvi et al. 2017a; Aaltonen & Turkulainen 2018)

In order to develop and maintain relational capital in a project both formal and informal socialization mechanisms are needed but earlier research has stressed more the formal socialization mechanisms (Bresnen 2007; Aaltonen & Turkulainen 2018). Informal socialization mechanisms are important at the beginning of an alliance project in the

tendering phase because they help to develop mutual trust and personal relationships and in the later phases when new participants appear to the project. Formal socialization mechanisms are beneficial in maintaining the achieved relational capital in alliance project's development phase. (Hietajärvi et al. 2017; Aaltonen & Turkulainen 2018) Aapaoja et al. (2013b) noted that both communication and interaction including trust building activities, information sharing and continuous and unrestrained coordination and cultural change including "best for the project" decisions, commitment to mutual objectives and "winning or losing together" attitude are highly important in creating integrated teams. Common working facility Big Room is an important organizational integration mechanism and one of its benefits is that it creates a context where informal relations can be formed (Hietajärvi et al. 2017a; Dave et al. 2015).

Technological mechanisms mean the use of information technology aiming to improve the integration of different systems and applications. The information technology can be seen as an interface tool to improve organizational integration. (Mitropoulos & Tatum 2000) Some examples of technology integration mechanisms are use of visual tools like Last Planner, virtual video meeting tools, physical and virtual meeting spaces like Big Room and IT tools for example Building Information Modelling (BIM) and project banks (Hietajärvi et al. 2017a). Technological mechanisms can be considered as a means of organizational integration because different co-locational physical meeting spaces like conference rooms, lunchrooms and hallways and integrated virtual spaces increase formal and informal communication and socialization (Gustavsson & Gohary 2012; Walker et al. 2017; Aaltonen & Turkulainen 2018).

2.1.2 Collaborative working spaces

In project management, inter-organizational integration and collaboration have become more popular due to arrival of different collaborative project arrangements. Many scholars have highlighted the importance of co-location, cross-functional teams and common working facilities in integration and coordination of projects (e.g. Leicht et al. 2009; Dave et al. 2015; Hietajärvi et al. 2017; Aaltonen & Turkulainen 2018). Co-location means that project participants are located in common working space. It increases the communication between participants that enhances the integration (Khanzode & Senescu 2012). One team working facility where participants are integrating, co-operating and collaborating is called Big Room. Big Room's concept is to be a physical or virtual space where project participants can work together with

modern technology with main objective to generate and share project-specific knowledge, which contribute to the project (Koskelo 2017, p. 85).

In addition to Big Room there have been many different concepts and definitions of common working facility and cross-functional teams such as interactive workspace (Leicht et al. 2009), collaborative space (Kokkonen & Vaagaasar 2017) and project space (Bosch-Sijtsema & Tjell 2017), for example. Moreover, there are some variations of Big Room, for example integrated Big Room (Khanzode & Senescu 2012), virtual Big Room (Dave et al. 2015) and intensive Big Room (Alhava et al. 2015). However, nowadays perhaps the most widely known and used term for common working location in IPD is Big Room. Therefore, in this research, Big Room is used as a general term for all these different collaborative shared working facilities and different variations of Big Room for the sake of clarity.

2.1.3 Big Room as an integration mechanism

Big Room is a technological and on the other hand an organizational integration mechanism. Need for it has emerged from increasing needs of inter-organizational integration and collaboration and challenges like project team members' geographical dispersion, coordination of different cultures and changes occurred by unexpected events. (Hietajärvi et al. 2017a) Purpose of the Big Room is to bring together different stakeholders such as designers, builders and end users (Cohen 2010; Khanzode & Senescu 2012; Hietajärvi et al. 2017a). Co-locational space, use of cross-functional teams and grouping project participants to work together intensively are strong organizational integration and formal socialization mechanisms (Mitropoulos & Tatum 2000; Aaltonen & Turkulainen 2018). However, Big Room is not only a formal socialization mechanism because in Big Room informal discussions and socialization take place and team spirit is fostered (Teasley et al. 2000; Aaltonen & Turkulainen 2018).

Main goals of Big Room are to support the integration between participants and to offer a common facility where open communication and interaction is possible (Dave et al. 2015; Hietajärvi et al. 2017a). In Big Room, the most critical problems should be discussed and eliminated and at the same time, mutual trust generated (Dave et al. 2015). Collaborative meetings in Big Room are workshops types of social activities and they enhance team creation, socialization, information sharing, commitment and

prioritization (Pekkinen & Kujala 2014). Big Room has been noted to be highly desirable in integrated project deliveries (Cohen 2010).

Systematic use of Big Room has many benefits related to integration and collaboration. Collaborative cross-team workplace helps to secure better time and cost certainty because it improves information and knowledge sharing (Cohen 2010). Radical co-location of teams benefits the coordination, problem solving and learning and improves the productivity (Teasley et al. 2000). Co-locating people in the Big Room can boost project participants' identification to the project. It is important because it reinforces the feeling of "us" and helps to build mutual trust and open communication. (Hietajärvi & Aaltonen 2018) Pekkinen and Kujala (2014) stated that in multinational large investment projects the collaborative meetings enhance the integration and coordination and reduces the uncertainty and equivocality in the project.

Co-location of teams and face-to-face meetings have noted to be highly valuable (e.g. Cohen 2010; Khanzode & Senescu 2012; Hietajärvi et al. 2017a). However, it is not always possible to be physically present in Big Room in geographically distributed projects (Dave et al. 2015; Hosseini et al. 2018). Dave et al. (2015) noted two other problems related to physical Big Room: constant presence of participants required in Big Room is impossible in small projects and projects are unique so it is hard and expensive to standardize developed processes and externalize lessons learned. In addition, co-location affects extra costs (Zenun et al. 2007). Due to problems with co-location and on the other hand increasing number of electronic tools, scholars have presented different virtual co-location and collaboration means (e.g. Leicht et al. 2009; Dave et al. 2015; Hosseini et al. 2018).

Leicht et al. (2009) presented framework for the use of interactive workspaces to support effective collaboration. Interactive workspace allows participants to access virtual contents from physical space and it fades the boundaries between virtual and physical environments. Virtual Big Room is concept where participants are co-located in the same virtual environment with communication and social networking possibilities. In virtual context, the same Lean tools than in physical Big Room for example BIM can be used. (Dave et al. 2015) Nowadays, usually physical and virtual contexts are combined for practical reasons to hybrid teams so both the virtuality and co-location are exploited (Hosseini et al. 2018).

Virtual teams and use of virtual Big Room are problematic and problems of virtual context include the lack of informal socialization, trust and accountability (Hosseini et al. 2018). Leicht et al. (2009) noted that when electronic tools and methods are used more widely the physical interaction might be left as an afterthought. When virtuality is in the use, clarification of expectations, training and solutions to build mutual trust are needed (Leicht et al. 2009). Face-to-face meetings help to maintain the effectiveness of hybrid teams and to reduce deficiencies of virtuality (Hosseini et al. 2018). Hietajärvi et al. (2017a) noted that virtual communication is easier and smoother when there exists mutual trust, people know each other and common goals are clear.

Important activities of Big Room include knowledge management, planning and facilitation of meetings, virtualization and Lean management tools and techniques (Dave & Koskela 2009; Khanzode & Senescu 2012; Dave et al. 2015). During a project, a major amount of knowledge is needed and used to achieve project goals and Big Room can make it easier to share and manage especially tacit knowledge (Dave & Koskela 2009). Big Room meetings should be well-planned and facilitated that needed participants are invited but unnecessary participants not and the time is used efficiently (Khanzode & Senescu 2012). Virtualization is becoming more widely used in Big Room's because modern technology enables smoother communication, simultaneous designing and information sharing through virtual platforms and for example, videoconferencing and BIM tools are nowadays important (Dave et al. 2015). For example, BIM has been found to be useful in design information integration (Hietajärvi et al. 2017a).

2.1.4 The most used Lean methods and tools in Big Room

There are many Lean management tools and techniques to be used in Big Room environment but some of the most important tools are for example BIM, Choosing by Advantages, Last Planner System, Set-based Design, Standardization in construction, Target Value Design and Information Visualization like A3 and project plans (Dave et al. 2015). Koskelo (2017, p. 63-65) found ten the most used and rated as the most potential Lean methods and tools in construction industry. They are presented in order of importance in table 1.

Table 1. Lean methods and tools in order of importance from Koskelo (2017, p. 63-65).

Average rate of potential	**Average rate of utilization**
Last Planner System	Last Planner System
Target Value Design	Target Value Design
Personnel engagement	Personnel engagement
Choosing by Advantages	IT systems
IT systems	Choosing by Advantages
Data Management	Data Management
Standardization	Visual Management
Visual Management	Standardization
Set-Based Design	Set-Based Design
A3	A3

There exists a lot more tools to be used. In addition, different contractual and organizational integration mechanisms and methods discussed above are also important to be noted. (Haapasalo 2018) Haapasalo (2018) simplified collaborative methods and divided them into four categories: value engineering, management of people, management of processes and activities and product data and information management and all the mentioned integration mechanisms, methods and tools can be placed on these four categories. It has to be noted that the use of Big Room concept or any other mechanism is not an end in itself but the mean to integrate people and to improve project performance by facilitating the work as an integrated team (Koskelo 2017, p. 89).

2.2 Stakeholder management

The purpose of stakeholder theory is to give managers the means to understand and manage stakeholders (Freeman 1984). Freeman (1984) defined stakeholder to "*any group or individual who can affect or is affected by the achievement of the organization's objectives*" and provided a starting point for approaches to stakeholder management. After Freeman, significant amount of studies have been made in the field of the stakeholder management and different approaches and tools to manage stakeholders have been presented (e.g. Donaldson & Preston 1995; Mitchell et al. 1997; Roloff 2008; Aapaoja & Haapasalo 2014). The stakeholder approach is an effective way to understand a company in its environment (Mitchell et al. 1997). Project stakeholder

management can be described as systematic identification, analysis and planning of actions targeting to communicate with and influence stakeholders (PMI 2008).

Stakeholders include various groups with different needs and requirements and it is very important to identify the stakeholders of the project. Thus, there has been many broad and narrow views to define stakeholders (Aaltonen & Kujala 2010). According to Aaltonen and Kujala (2010), broad definitions (e.g. Freeman 1984; Turner 1999; PMI 2008; Ward & Chapman 2008) emphasize the fact that parties that can affect or be affected by the project are stakeholders. This definition can be criticized because it makes almost all groups and individuals project stakeholders (Aaltonen & Kujala, 2010). Scholars who have noted the problem with broad stakeholder definition have presented narrower views of the stakeholders (e.g. McElroy & Mills 2000; Olander 2007; Chinyio & Akintoye 2008). Narrower views stress the need for a certain kind of interest or stake of the group or individual in order that it can be defined as a stakeholder (Olander 2007; Aaltonen & Kujala 2010).

Stakeholders are typically divided to internal and external or primary and secondary stakeholders (Mitchell et al. 1997; Aaltonen & Kujala 2010). Internal stakeholders refer usually to primary stakeholders who are formal members of the project coalition. External stakeholders that are referred as secondary stakeholders are not formal members of the project coalition. (Aaltonen & Kujala 2010) Stakeholders who are owners of the company or the capital, actors, voluntarily in contact with the company, right-holders, contractors, resource providers, risk-takers or legal principals can be classified to primary stakeholders. Those stakeholders who are non-owners of the company, owners of less tangible assets, acted upon, involuntary in contact with the company, involved for moral reasons, dependents of the company or influencers can be classified to secondary stakeholders. (Mitchell et al. 1997)

Stakeholder management philosophy constitutes from attitudes, structures and practices (Donaldson & Preston 1995). Its objective is to identify, analyze and plan actions to influence and communicate with stakeholders (PMI 2008). Stakeholder management is a very important part of the project management and in order to ensure project success the project managers should consider stakeholders' requirements and needs (Olander & Landin 2005). Project stakeholder management's main purpose is to manage the relationship between the project and its stakeholders (Aaltonen et al. 2008).

2.2.1 Stakeholder analysis

Multinational large projects take place in complex and uncertain external stakeholder environment. The stakeholders of the project can have different claims, rights and expectations and they can influence to the organization's processes (Freeman 1984). In project management point of view, it is important to identify and analyze those stakeholders who can have influence to the project (Olander & Landin 2005; Walker et al. 2008). Stakeholders who could affect the project can be considered as salient stakeholders. According to Mitchell et al. (1997, p. 869) stakeholder salience means, "the degree to which managers give priority to competing stakeholder claims." When important and salient stakeholders who might influence the project are identified, the strategy for their management can be formed.

It is essential to build interpretations by conducting stakeholder analysis because only then stakeholders can be managed optimally. Stakeholder analysis is a process attempting to understand and read the project's stakeholder environment. (Aaltonen 2011) Daft and Weick (1984) presented one of the most acknowledged models proposing organizations to be interpretation systems. Interpretation is a process, which gives meaning for the information and helps to choose the right actions (Daft & Weick 1984).

According to the model Daft and Weick (1984) created, the organizations have different modes and processes for interpreting their environment. Interpretation processes have two dimensions for organizational action: organizational intrusiveness and assumptions about environment. Organizational intrusiveness can be passive or active and assumptions about environment analyzable or unanalyzable. (Daft & Weick 1984) Interpretation processes play an important role in project management and they are especially important in understanding external project stakeholder environment (Aaltonen 2011).

Three phases of interpretation process are data scanning, data interpretation and strategy formulation and decision-making. In data scanning phase the managers scan the environment and gather data about changes taking or potentially taking place in that environment. Then the managers analyze and interpret that information gathered in order to understand and identify the most important things. In the end, they make decisions based on these interpretations. (Daft & Weick 1984) Correspondingly, in

project stakeholder analysis there are these same three important elements: data collection concerning project stakeholders and their characteristics, stakeholder identification and classification and formulation of stakeholder management strategy based on the results of stakeholder identification and classification (Aaltonen 2011; PMI 2008). Next paragraphs present project stakeholder analysis phases with suitable tools and methods adapted from Aaltonen (2011).

The scanning process including the stakeholder data collection offers the input to make the stakeholder identification and characterization. There exist many different methods to be used in project stakeholder data collection and at its simplest it is only a list of stakeholders possibly involved to the project made by project management. (Aaltonen 2011) Some examples of data collection methods are generic stakeholder lists (Pouloudi & Whitley 1997), snowball interview technique (Goodman 1961; Cova et al. 1996), face-to-face interviews (Varvasovszky & Brugha 2000), surveys and semi-structured questionnaires (Cova et al. 1996) and public meetings, public hearings, workshops and surveys (El-Gohary et al. 2006).

Stakeholder identification and classification is the actual interpretation process where collected data gets the meaning. Its purpose is to facilitate the understanding of how to manage the stakeholders in changing and unforeseen environments. (Aaltonen et al. 2008) Stakeholder identification is an iterative process and it should be done systematically (Pouloudi & Whitley 1997). Stakeholder identification and classification has many related methods to be used and some of them are presented in the next chapter. Some examples of stakeholder identification and classification methods are stakeholder salience model (Mitchell et al. 1997), stakeholder mapping (Winch & Bonke 2002), stakeholder power/interest matrix (Johnson & Scholes 1999; Olander & Landin 2005), impact/probability-matrix (Olander 2007) and framework for stakeholder identification and classification (Aapaoja & Haapasalo 2014).

After stakeholder identification, characterization and classification the strategy formulation and decision-making process can take place with a goal to formulate the project management strategy (Aaltonen 2011). According to PMI (2008), stakeholder analysis tools provide a good foundation to select appropriate stakeholder management strategies. In turn, some scholars have claimed that it is not possible to form a stakeholder management model because project environments' are too dynamic and

uncertain (e.g. Floricel & Miller 2001). Some examples of methods and tools for formulation of stakeholder management strategy are the manage closely, keep satisfied, keep informed and monitor from stakeholder impact/probability-matrix (Johnson et al. 2008, p. 156; Olander 2007), stakeholder engagement strategy from stakeholder circle (Bourne & Walker 2005), early involvement (Aapaoja 2013a) and framework for stakeholder identification and classification (Aapaoja & Haapasalo 2014).

2.2.2 Stakeholder analysis tools and methods

There are many methods to collect data about stakeholders and their characteristics. Different stakeholder identification and classification methods and tools can be used to assess the influences different stakeholders can have. (Aaltonen 2011) In addition, many of these methods and tools can be used in stakeholder strategy formulation process for example when project manager has to decide how much attention different stakeholder groups should get. Next, some of the stakeholder data collection, identification, classification and management strategy formulation tools and methods especially suitable for internal stakeholders' processing are presented.

Generic stakeholder lists

One of the easiest methods to identify stakeholders is a generic stakeholder list. In generic stakeholder list, there are typically listed all generic stakeholders who might be connected to the situation. (Pouloudi & Whitley 1997) Freeman (1984) suggested that generic stakeholder list should lead to list of specific stakeholders and it means that for example, subcontractors should be divided to subcontractor A and subcontractor B instead of "subcontractors". Generic stakeholder list used alone is not a systematic stakeholder identification approach and for that reason, it is not valid in all contexts (Pouloudi & Whitley 1997). For example, in a complex project, identification of generic stakeholders might not be enough.

Face-to-face interviews

Face-to-face interviews can be conducted as structured interviews, semi structured interviews or checklists and they all are useful tools to interview primary sources of information (Varvasovszky & Brugha 2000). For example, snowball sampling is usually complemented with some kind of interview to find new participants but also to gather

information from stakeholders (Goodman 1961). In addition to interviews, different types of surveys can be used to gather information from a larger group (Cova et al. 1996).

Stakeholder salience model

Stakeholders can influence the project in many ways and from project management point of view, it is essential to identify stakeholders who might have an influence on the project. This influence can be assessed through stakeholder identification and salience model Mitchell et al. (1997) presented. According to them stakeholder salience is *"the degree to which managers give priority to competing stakeholder claims"* (Mitchell et al. 1997, p. 869). In other words, stakeholder salience model defines the amount of attention the project managers should pay to different stakeholders' claims.

Salience of project stakeholders varies and it is important to assess the salience to be able to validate the stakeholders' requirements (Aapaoja 2014, p. 54). Stakeholder salience consists of three attributes: power (P), legitimacy (L) and urgency (U) and the amount of stakeholder's salience is dependent of number of attributes stakeholder possess (Mitchell et al. 1997; Aaltonen et al., 2008). On the other hand, stakeholder salience tells how much priority project managers are willing to give to competing stakeholder claims (Aaltonen et al. 2008). Mitchell et al. (1997) divided the stakeholders into eight classes and these classes into four groups according to the amount of salience attributes: power, legitimacy and urgency stakeholders possess. Stakeholder groups and classes are presented in table 2.

Power is the attribute that is tricky to define but easy to recognize when it is used. Power can be capsulized to be the ability of those who possess it to be able to enforce the outcomes they desire despite resistance. In other words, stakeholder who possess power can make another stakeholder to do something that the stakeholder would not otherwise have done. Power can be divided to coercive, utilitarian and normative power depending how the power is exercised. Power is coercive when physical resources of force, violence or restraint are used to exercise power. It means that power is compelling and threatening. Utilitarian power is use of material or financial resources to seek own objectives. Normative power is based on symbolic resources. It does not contain any physical threat or a material reward. (Mitchell et al. 1997)

Legitimacy is based on justification of stakeholder actions. Stakeholder has legitimacy when actions of that stakeholder are seen as desirable, proper or appropriate within some socially constructed system of norms, values, beliefs and definitions. Legitimacy can be due to society, organization or individual. (Mitchell et al. 1997) Project managers are more likely willing to pay attention to claims from stakeholders that they find to be legitimate (Aaltonen & Kujala 2010). However, it is important to note that stakeholder with a legitimate claim does not necessarily seem to be salient in eyes of the project manager if the stakeholder does not have the power to enforce that claim (Mitchell et al. 1997).

Urgency is not as concrete attribute as power and legitimacy, but it is an important attribute and needed to make the model more dynamic. Because of the stakeholders' urgency, the interactions between stakeholders occur and stakeholder salience is dynamic over time. Urgency is the degree of how likely the project managers are paying instant attention to stakeholder claims. Urgency exists when two conditions are fulfilled: claim or relationship of the stakeholder is critically important and time-sensitive thus: urgency consists of criticality and time sensitivity. Criticality means the importance of the claim to the stakeholder and time sensitivity refers to unacceptable managerial delay in attending to the claim or relationship of the stakeholder. (Mitchell et al. 1997) Time sensitivity is important because claims presented after critical decisions are more likely rejected (Aaltonen & Kujala 2010). Urgency can be understood to be a critically important and time sensitive interest of the stakeholder. In the construction industry, negative consequences that can affect project objectives and implementation seem to be important factors increasing the urgency of the claims (Olander & Landin 2005).

Stakeholders with one salience attribute are called latent stakeholders. Latent stakeholders are not probably getting much attention from project managers and they may not be even recognized as stakeholders. In the other way around, latent stakeholders are not possibly giving attention or acknowledgement to the company or to the project. Stakeholders with power are dormant stakeholders, with legitimacy discretionary stakeholders and with urgency demanding stakeholders. (Mitchell et al. 1997)

Dormant stakeholders possess power and are able to use it for their own favor but do not have urgent claims or legitimate relationships with the company. Therefore, their power

usually remains unused. However, dormant stakeholders may acquire another attribute and become more salient. For that reason, management should be aware of dormant stakeholders because for example, fired workers can become more salient and seek ways to use their latent power. (Mitchell et al. 1997)

The relevant attribute for discretionary stakeholders is legitimacy. They have no urgent claims or power to influence the company, so managers have lack of pressure to engage in an active relationship with them. Managers can nevertheless decide to be in contact with discretionary stakeholders if they want. (Mitchell et al. 1997) For example, nonprofit organizations receiving donations from companies can be discretionary stakeholders for these companies because they do not have power or urgent claims on the company.

Demanding stakeholders possess urgency but not power or legitimacy. They can be seen as demanding because they have no means to get through their will. Demanding stakeholders have urgent claims but not usually get much attention from management if they do not manage to become more salient. (Mitchell et al. 1997) For example, small environmental organization's demonstration against a corporation can be viewed irritating but does not lead to actions if organization does not have power or legitimate status to carry out its will.

Expectant stakeholders possess two out of three salience attributes so it makes their salience level higher than latent stakeholders have. Expectant stakeholders can be seen to expect something from the company because their combination of two attributes makes them more active and the company has more reasons to respond to their demands. Stakeholders with power and legitimacy are called dominant stakeholders, with power and urgency dangerous stakeholders and with legitimacy and urgency dependent stakeholders. (Mitchell et al. 1997)

Dominant stakeholders have legitimate claims on the company and power to act if they see it necessary but no urgent claims. Expectations of dominant stakeholders are relevant and they matter to managers. Dominant stakeholders have some kind of formal mechanism that confesses their relationship with the company. (Mitchell et al. 1997) For example, corporate board has power and legitimacy but not necessarily urgency so it can be dominant stakeholder. According to Mitchell et al. (1997), some scholars have tried to make dominant stakeholders to be the only stakeholders of the companies. They

expect and receive much attention from management and are important stakeholders but they are not by any means the only set of stakeholders whom managers should concern and pay attention (Mitchell et al. 1997).

Dangerous stakeholders possess power and urgency but have a lack of legitimacy. They are coercive because illegitimate status often results the use of coercive power and they might possibly be violent so they are called as "dangerous". Good examples of dangerous stakeholders are environmentalists who put spikes into trees that are going to be logged and political or religious terrorists who use bombings, shootings or kidnapping to receive attention to their claims. It is important to identify dangerous stakeholders to be able to mitigate or prevent their actions. (Mitchell et al. 1997) On the other hand, "dangerous" stakeholders can become legitimate for example by allying with a legitimate stakeholder or winning elections and after that they are seen as "definite" instead of "dangerous" stakeholders.

Dependent stakeholders have urgent legitimate claims but no power to carry out their will so they need help from other stakeholders or from the company's managers. In such case, the power is not reciprocal so it is more like an advocacy or tutelage. For example, in the cases where the company causes environmental problems there are usually many different stakeholder groups with urgent legitimate claims but no power to carry out their will like for example local residents and animals. They need help from other stakeholder groups with power attribute and with that help, dependent stakeholders can become more salient. (Mitchell et al. 1997)

Definitive stakeholders possess all three attributes, so their salience level is high and they are most likely members of the dominant coalition of the company for example major stockholders. Managers have a clear and instant mandate to prioritize and act when they receive the claims of definitive stakeholders. Expectant stakeholders can become definitive stakeholders if they manage to acquire the missing attribute. (Mitchell et al. 1997) This highlights the dynamic nature of stakeholder salience and the importance of continuous stakeholder evaluation.

Stakeholder salience is dynamic, and it can vary during the project if stakeholders manage to get more attributes (Mitchell et al. 1997). Stakeholders have many strategies to be used to increase their salience including coalition building, communication, conflict escalation, creditability building, direct action, direct withholding, indirect

withholding and resource building strategies (Aaltonen et al. 2008). Stakeholders possessing power and legitimacy are already dominant stakeholders and they transfer easily into definitive stakeholders when their claims are urgent (Mitchell et al. 1997). Stakeholders can also lose their salience attributes and become less important. There are some limitations in the stakeholder salience model because stakeholder salience is dynamic so salience and the number of attributes of a particular stakeholder can change at any moment and attributes are not dichotomous or ready states so they should be seen more like a continuum. However, in the model attributes are either "present or absent". (Mitchell et al. 1997; Aaltonen et al. 2015)

Table 2**.** Stakeholder groups and classes from Mitchell et al. (1997).

Stakeholder group	Stakeholder class	Definition	Salience attributes possessed
Definite stakeholders	Definite stakeholders	A member of a company's dominant coalition. Managers have a clear and instant mandate to attend and give priority to the urgent claims.	P,L,U
Expectant stakeholders	Dominant stakeholders	Expectations of any dominant stakeholders are relevant and their influence is verified.	P,L P,U
	Dangerous stakeholders	Stakeholders that are coercive and possibly violent are "dangerous".	L,U
	Dependent stakeholders	These stakeholders are dependent on other stakeholders' power to carry out their will.	
Latent stakeholders	Dormant stakeholders	Possess power without any urgent claims or legitimate relationship and therefore the power is not used.	P
	Discretionary stakeholders	The managers have no need to associate with these stakeholders but they can choose to do so.	L U
	Demanding stakeholders	Stakeholders who can be irritating but whose claims does not get attention of the managers.	
Non-stakeholders	Non-stakeholders	Not salient. They cannot be included to the project stakeholders.	-

Stakeholder power/interest matrix (Johnson & Scholes 1999; Olander & Landin 2005) and stakeholder impact/probability matrix (Olander 2007)

Johnson and Scholes (1999) noted that it is not enough to only identify stakeholders because it is important to categorize them and to create different management plans for different stakeholder classes. Power/interest matrix is a mapping and categorizing technique to assess stakeholders' interests in influencing the project and their ability to do so (Johnson & Scholes 1999; Winch & Bonke 2002; Olander & Landin 2005). It is a

tool for project management to be able to understand stakeholders better and to build a communication and management plan for different types of stakeholders (Johnson & Scholes 1999; Olander & Landin 2005). In power/interest matrix, the amount of power is in the vertical axis and level of interest is in the horizontal axis. Power/interest matrix is presented in figure 3.

Figure 3. Power/interest matrix (modified from Johnson & Scholes 1999).

In power/interest matrix, stakeholders are divided into four groups with different management and communication plans. Stakeholders with low level of interest and low power are “minimal effort”, high level of interest and low power “keep informed”, low level of interest and high power “keep satisfied” and high level of interest and high power “key players”. Minimal effort stakeholders should get the least attention from project management and key player stakeholders the most. (Johnson & Scholes 1999; Olander & Landin 2005) Power/interest matrix has problems because it has a lack of dynamism (Olander & Landin 2005; Olander 2007). It is very hard to evaluate the power the stakeholders possess in a scale low to high and the level of interest does not necessarily mean anything. Instead of them, it would be more important to define how high is the probability that the stakeholder decides to make an impact and how high is the level of that impact. (Olander 2007)

Olander (2007) developed the stakeholder impact/probability matrix to solve the above-mentioned problems with power/interest matrix. The classes of stakeholders are similar

but the difference is that instead of power and level of interest, level of impact and probability of impact are evaluated. (Olander 2007) Impact/probability matrix is presented in figure 4.

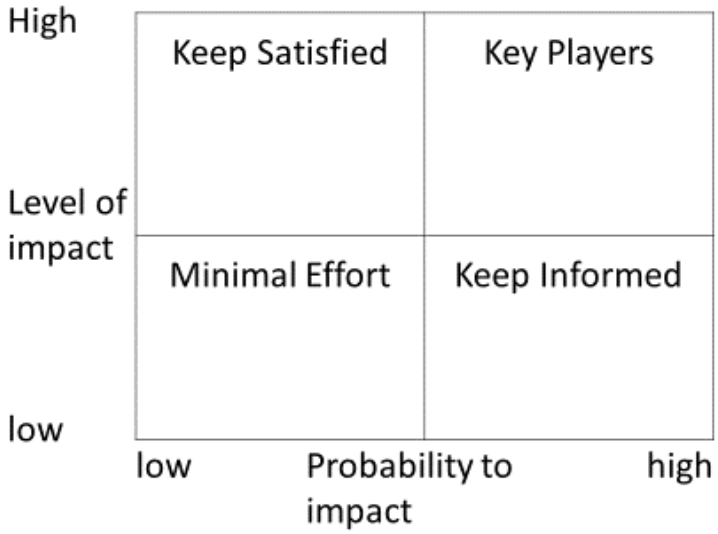

Figure 4. The stakeholder impact/probability matrix (modified from Olander 2007).

Level of impact defines how big is the impact to the project if stakeholder from certain stakeholder group decides to act and probability to impact defines how likely the stakeholder is going to use that possibility to make an impact (Olander 2007). The use of the matrix can be explained with two questions: how interested is the stakeholder to express its interest or contribution to the project and does the stakeholder have enough power to be able to do so. Managers' communication and management plans are similar than in power/interest matrix. (Olander 2007; Aapaoja & Haapasalo 2014) One problem with impact/probability matrix is that the level of impact is hard to evaluate without any scale referring to stakeholder salience and amount of attributes (Aapaoja & Haapasalo 2014).

Early stakeholder involvement (e.g. Aapaoja et al. 2013a)

Early stakeholder involvement means that project key participants take part of the project earlier than usually in traditional project delivery. For example, stakeholders possessing design and construction knowledge and skills and potential to contribute to the design and planning in a positive way should be involved to the project definition

phase (Aapaoja et al. 2013a). IPD requires early involvement of key participants from the earliest practical moment because expertise of them is wanted to be taken into use (AIA 2007). Early involvement improves the possibilities for closer integration and it has been seen that it strengthens the commitment of participants to the project and helps to make better informed decisions in the early stages of the project when there are better chances to make changes (AIA 2007; PMI 2008; Lahdenperä 2012). Early involvement and assessment is one of the cornerstones for creating an integrated project team (Aapaoja et al. 2013b).

Aapaoja et al. (2012) noted that early stakeholder involvement to the same integrated process helps in maintaining the focus on the project's content and customer requirements. Early involvement and integrated teams can help to improve quality, enhance value co-creation and reduce costs in construction projects. Early stakeholder involvement is important but not all stakeholders should be involved similarly because stakeholders have different roles, responsibilities and saliences in the projects. (Aapaoja et al. 2013a) For that reason, Aapaoja et al. (2013a) constructed a model for different levels of stakeholders in a renovation project where stakeholders are divided into five different levels including primary, secondary, system integrators, tertiary and external levels with different coordination and management recommendations.

Primary level includes stakeholders who are the direct recipients of the project and whose needs have the highest priority. For example, project customer represents the primary level stakeholders. Secondary level stakeholders are usually in the development team of the project and they have direct responsibilities to the customer so they provide services directly to the primary level. System integrators are the stakeholders who integrate the different parts of the project together. System integrators might include main engineer and contractor for example. Especially these parties are crucial to involve early and they together with primary and secondary level stakeholders should form the project core group. Tertiary level stakeholders are product and service providers with most project resources so they should be managed carefully but not involved as comprehensively as the core group stakeholders are involved. Early involvement of external stakeholders is not important usually. (Aapaoja et al. 2013a)

Framework for stakeholder identification and classification (Aapaoja & Haapasalo 2014)

Aapaoja and Haapasalo (2014) presented framework for stakeholder identification and classification. The aim of the framework is to identify and involve stakeholders that may contribute to the project and thus enable the creation of an integrated project team. It consists of four phases: first project purpose and customer constraints are defined, then stakeholders are identified according to their functional role, then stakeholders' salience and probability to impact are evaluated and finally stakeholders are classified and prioritized according to four groups that are presented later. (Aapaoja & Haapasalo 2014)

Defining the project purpose and customer constraints are the main tasks when the project starts and their documentation is essential (Razali & Anwar 2011; Aapaoja & Haapasalo 2014). After that, it is important to identify the stakeholders and their functional roles. It is important to identify the functional roles because traditional division to internal and external stakeholders is insufficient. (Cova & Salle 2005; Aapaoja & Haapasalo 2014)

Next phase is assessing the stakeholder importance. Aapaoja and Haapasalo (2014) noted that stakeholders' contribute to the project and probability to influence varies so it is essential to evaluate the stakeholders' salience and probability to impact and ability to contribute to the project. They presented a modification from Olander's (2007) impact/probability matrix called as stakeholder assessment matrix, which is presented in figure 5. Probability to impact is similar than the horizontal axis in Olander's (2007) matrix but Aapaoja and Haapasalo (2014) noted that the probability to impact could be understood also as stakeholders' ability to contribute. Level of impact in vertical axis is changed to amount of salience including the stakeholder classes from Mitchell et al. (1997). The higher the level of impact the stakeholder can cause, the more salient the stakeholder is and its importance in the project is higher (Aapaoja & Haapasalo 2014). The stakeholder classes in Aapaoja and Haapasalo (2014) matrix are similar than in matrices, Johnson and Scholes (1999) and Olander (2007) presented but there are some additional specifications as follows:

- Key players are Primary team members (PTM)
- Keep informed are Key supporting participants (KSP)
- Keep satisfied are Tertiary stakeholders
- Minimal effort are External stakeholders

Most salient participants possessing at least two attributes are the “key players” of the project. Stakeholders in next two classes “keep informed” and “keep satisfied” possess from one to two attributes and their probability to impacts varies. These two classes are very similar but the most significant difference is that “keep informed” stakeholders are in the inner circle of the project so they have usually more interest to contribute and for these reasons they are called “key supporting participants”. Stakeholders that are “keep satisfied” have less interest so they are called “tertiary stakeholders”. Stakeholders with “minimal effort” are called “extended stakeholders” and they possess only one attribute. (Aapaoja & Haapasalo 2014)

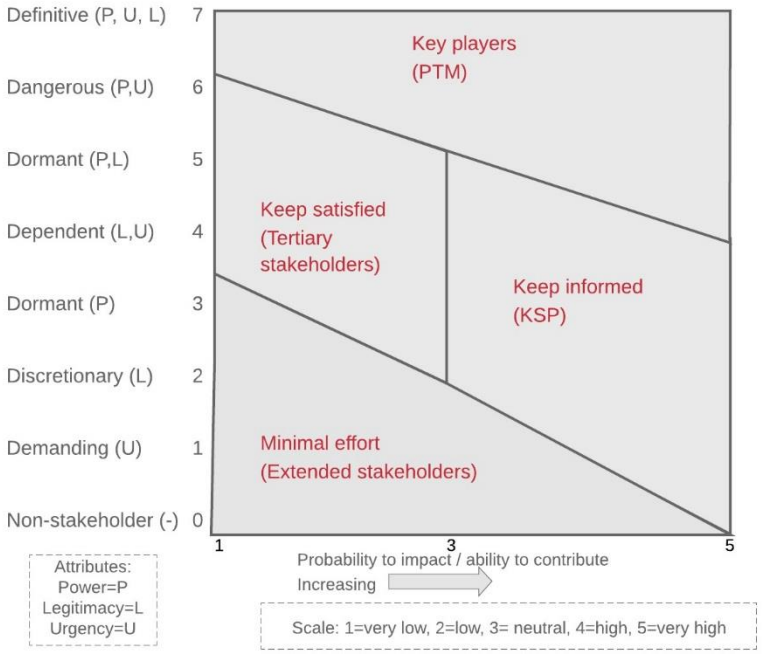

Figure 5. Stakeholder assessment matrix (modified from Aapaoja & Haapasalo 2014).

Final phase is to classify stakeholders at different levels and to form a team. Stakeholders cannot be involved similarly and for that reason classification and prioritization of them based on information gathered earlier is important (Razali & Anwar 2011; Aapaoja & Haapasalo 2014). PTM and KSP are internal stakeholders and tertiary and extended stakeholders are external. Stakeholders in PTM are core group of the project including for example customer, architect and main contractor. Roles of KSP stakeholders are also important but the functions they have are more individual. Examples of KSP stakeholders are consultants, subcontractors and designers but the line between PTM and KSP is fine and composition of groups varies between projects.

Difference between the two external stakeholder groups: tertiary and external stakeholders is that tertiary stakeholders provide some sort of input and external stakeholders do not have any direct control or resources in the project but they may have interest. (Aapaoja & Haapasalo 2014)

The framework is simple to use, it provides good support for stakeholder classification and involvement and helps to form a clear understanding of stakeholders and their contributions that can help in enhancing the project value creation. The problem with stakeholder identification and classification framework is that it does not consider any changes in the stakeholder network so it is not dynamic. Therefore, the framework should be used again every time when there are any changes in the stakeholder network or in stakeholder salience levels. (Aapaoja & Haapasalo 2014)

Stakeholder strategy formulation

Many of the above-mentioned tools can be used in stakeholder management strategy formulation process. For example, stakeholder salience model is meant to describe how much attention the project management gives to a certain stakeholder based on the attributes it possess (Mitchell et al. 1997). It can be understood as a stakeholder management strategy because it predicts how likely the project manager acts when different stakeholders make claims. Framework for stakeholder identification and classification has aspects on how stakeholders should be classified and prioritized and then managed and involved differently so it can be understood as a tool for stakeholder strategy formulation (Aapaoja & Haapasalo 2014).

2.3 Level of collaboration

Integration has been noted to be important in organizations and in projects and there are several different levels to integrate and many different methods and tools to manage integration. Organizations that are effective in integration management always fit their integration mechanisms with existing needs and requirements and they do not under- or over-integrate (Lawrence & Lorsch 1967; Turkulainen et al. 2015). It has been noted that there is a lack of collaborative culture in the construction industry (Mitropoulos & Tatum 2000) but there exists awareness of the need to improve inter-organizational integration and team integration (e.g. Baiden et al. 2006; Aapaoja et al. 2012; Aapaoja

et al. 2013b). According to Baiden et al. (2006), fully integrated project teams are not necessarily obligatory for effective teamwork and when they are used there exists significant organizational and behavioral barriers to obtain the benefits of the integration in the construction projects. It is noted that project teams with different levels of integration can have similar levels of teamwork effectiveness (Baiden & Price 2011).

Level of collaboration can be seen as a continuum in supply chain integration where integration has different maturity levels regarding the commitment, trust and needed resources (Cousins & Spekman 2003). According to Cousins and Spekman (2003) different integration levels of the continuum are open market negotiation, cooperation, coordination and collaboration. The continuum of supply chain integration is presented in the figure 6.

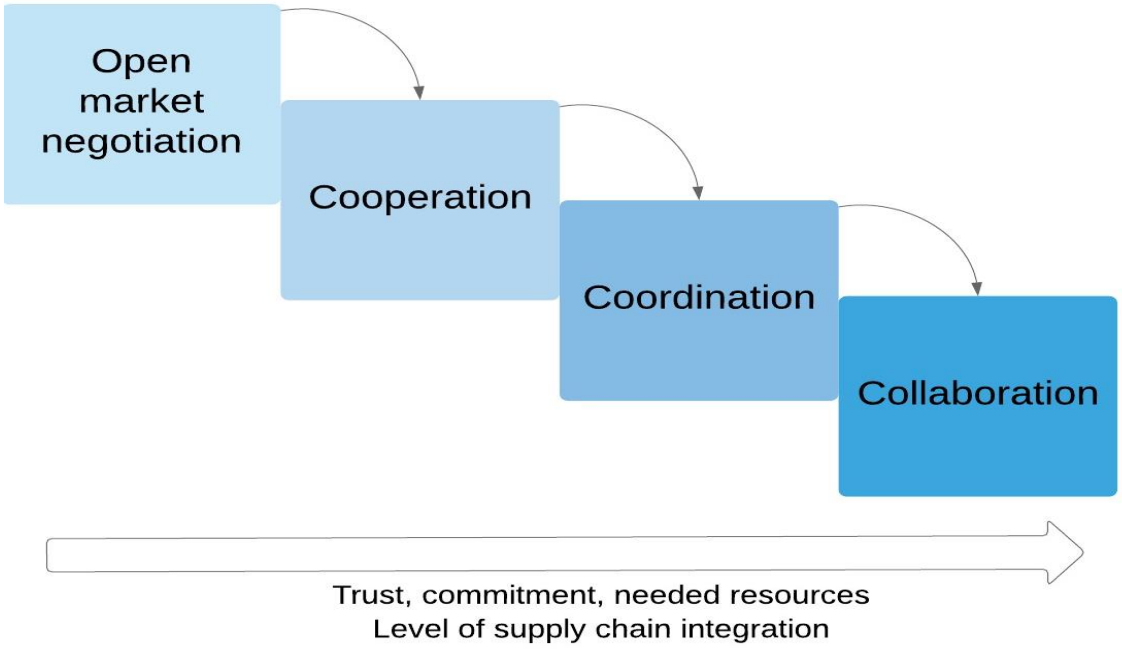

Figure 6. The continuum of supply chain integration (modified from Cousins & Spekman 2003; Laiho 2015, p. 32).

In open market negotiation level, integration is based on individual price negotiations, agreements and contracts. In cooperation level, actors form longer relationships and contracts and reduce actively the number of suppliers. In coordination level, there exists information linkages and the information exchange is easier and happens with more

routine. (Cousins & Spekman 2003) In advanced supply networks, all the main supplier and customer relationships have reached the cooperation or coordination level (Laiho 2015, p. 32). In the collaboration level, the supplier and customer relationships are on the most integrated level and supplier network develops new methods and tools to maximize the benefits but it requires high level of resources, capabilities, trust and commitment. Therefore, instead of the highest level of integration, the target should be appropriate level of integration and not every relationship should be on the collaboration level. (Cousins & Spekman 2003; Laiho et al. 2009)

In projects, the stakeholders have different roles, requirements, interests and salience. Especially, in the big and complex megaprojects the wide range of competencies are needed from different stakeholders and this affects huge amount of interdependencies between stakeholders (Aapaoja et al. 2013a). Stakeholders should be divided into different levels of collaboration and different levels should have divergent and appropriate requirements considering for example the use of collaborative methods and early involvement because project management cannot involve all stakeholders to the project similarly. Thus, the stakeholder classification and prioritization process is needed. (Aapaoja et al. 2013a; Aapaoja & Haapasalo 2014) In other words, the level of integration and collaboration between stakeholders and involvement of stakeholders should differentiate based on stakeholder classification.

Integration forms the foundation for inter-organizational collaboration but it is not an end in itself but a mean to facilitate communication and mutual trust between parties and individuals and to enable better results from the project (Ghassemi & Becerik-Gerber 2011; Aapaoja et al. 2012; Ibrahim et al. 2013b). Closer collaboration and integration are needed to enhance the value creation and the flow of the construction project (Bertelsen & Koskela 2004). Collaboration can be seen as a continuous process with the objective to improve team culture and professional attitudes and to enhance a spirit of collaboration (Dainty et al. 2001; Baiden et al. 2006; Hauck et al. 2004).

Statsenko et al. (2018) presented tiered procurement structure of the mining supply chain. There mining companies present the “highest hierarchy level” as the end customers. Tier-1 suppliers get opportunities and orders directly from the mining companies. Tier-1 suppliers include commonly Engineering, Procurement and Construction Management (EPCM) consultant that provides services for design,

procurement and construction work coordination but sometimes also, Original Equipment Manufacturers (OEMs) can be Tier-1 suppliers. EPCM provider is responsible for the engineering, procurement and construction management on behalf of the customer and OEMs provide high-technology equipment. However, usually both OEMs and Engineering and specialist services are Tier-2 suppliers and they are subcontractors of the EPCM consultant. Engineering specialist services include design, management and installation related tasks like engineering design, civil construction, electrical engineering and water or tailings management. Tier-3 suppliers receive opportunities and orders from Tier-1 and Tier-2 subcontractors and they provide large packages of work including technology, equipment or services. They can provide for example sub-components for OEMs or IT services to EPCM. Tier-4 suppliers supply niche products for Tier-2 and Tier-3 suppliers. (Statsenko et al. 2018)

2.3.1 Collaborative process

According to Schöttle et al. (2014, p. 1275), "*Collaboration is an interorganizational relationship with a common vision to create a common project organization with a commonly defined structure and a new and jointly developed project culture, based on trust and transparency; with the goal to jointly maximize the value for the customer by solving problems mutually through interactive processes, which are planned together, and by sharing responsibilities, risk, and rewards among the key participants*." Relational attitudes create the necessary foundation for team working and collaborative practices including for example, formal team integration, team building and joint risk management. Communication, coordination and mutual trust and support for example ensure that team working, and collaborative practices remain in focus during the project. (Suprapto et al. 2015a)

Collaborative process needs commitment from the stakeholders and their early involvement to the same integrated process (Aapaoja et al. 2012). This commitment can be generated from the use of integration mechanisms (Hietajärvi et al. 2017a) and collaborative practices and socialization including workshops, joint training, use of collaboration facilitators, relationship programs and collaborative co-locational spaces for instance (Aaltonen & Turkulainen 2018; Hietajärvi & Aaltonen 2018). It is valuable to notice that although collaboration in both co-located and virtual cross-functional teams require learning, the teams create their own practices suitable for the situation (Robey et al. 2000).

It is noted that better team and stakeholder integration and collaboration solve problems occurred from traditional contract practices and habits in the fragmented construction industry (Aapaoja et al. 2013b). One of the main reasons to develop different collaborative project arrangements like IPD has been the need to enhance collaboration and integration, the key issues of IPD (Lahdenperä 2012; Aapaoja et al. 2013b). Team collaboration in IPD, offers much better understanding of project constraints and possibilities than there would be in a traditional project delivery. Substantial co-location, an integrated risk mitigation strategy, behavioral characteristics and normative practices like trust-control-balance, open-books, best-for-the-project-mindset and no blame-culture and processes, means and routines that support above mentioned behavior like consensus decisions making, mutual dependency and accountability between parties and common pain and gain sharing helps the team to manage better uncertainty and ambiguity. (Walker et al. 2017) Collaboration cannot be defined by the quality of its outcomes but by its ability to improve team participation and communication during the tasks (Leicht et al. 2009).

Scholars have defined collaborative process to be a process including several different elements and techniques to facilitate the integration (e.g. Baiden et al. 2006; Thomson & Perry 2006; Shelbourn et al. 2007). Collaborative process can be simplified to four different categories: value for money thinking, management of people, management of activities and management of information and product information. Value for money thinking includes Lean tools such as Value Engineering, Target Value Design, management of innovations and decision-making structures. (Haapasalo 2018, p. 27) Management of people and management of activities and processes include similar things than integration mechanisms presented e.g. by scholars Mitropoulos and Tatum (2000), Dave et al. (2015) and Hietajärvi et al. (2017a). Management of people contains teaming processes, common rules and project personnel management and management of activities and processes contains Big Room, cross discipline co-operation, Last Planner System and visual control. Information and product information management include technological integration mechanisms such as common information systems, communication practices and information modelling. (Haapasalo 2018)

2.3.2 Collaborative identity

Focus of collaboration should be in the interpersonal and inter-organizational relationships and the formation of collaborative project identity is important.

Collaborative project identity formation improves team mobilization and commitment and strengthens the shared feeling of "us". (Hietajärvi et al. 2017a; Hietajärvi & Aaltonen 2018) Hietajärvi and Aaltonen (2018) identified six activities in alliance projects that are important in creating a self-image of the project and are the fundamental elements of collaborative project identity formation, which is composed of collaborative values, co-operation and shared working practices:

- Articulating a joint vision for collaborative project identity
- Converging on mutual conceptions of collaborative project alliance philosophy
- Attaining a shared collaborative mentality
- Designing ways of working with multiple identities
- Attaining distinctiveness
- Legitimizing activities

Above-mentioned activities concern temporary organizations and there especially time and context affect to identity formation because projects are timely limited and people have different contexts and multiple organizations and identities in project type of working. To be able to improve the collaborative project identity formation people should be removed farther from the idea of temporary and people should be able to handle these multiple identities. (Hietajärvi & Aaltonen 2018) Team building skills help to form a cohesive alliance project organization by formation of collaborative project identity and by reducing organizational boundaries (Walker & Lloyd-Walker 2015; Hietajärvi et al. 2017a). Next chapter presents practical preconditions and cornerstones for successful team integration and collaboration that can be seen as a parallel matter for collaborative identity formation.

2.3.3 Preconditions of successful team integration and collaboration

Constructing Excellence (2004) described that effective teamwork consists of collaboration, participation, shared vision, communication, issue negotiation and resolution, reflection and self-assessment and team identity. Successful team integration and collaboration form the base for effective teamwork (Aapaoja et al. 2013b; Baiden et al. 2006) and early stakeholder involvement and the creation integrated project teams have been seen as means to enhance value co-creation, cost reduction and quality improvement in projects (Lahdenperä 2012; Aapaoja et al. 2013a).

Early involvement of project participants means connecting the different stakeholders to the project from the earliest practical moment (AIA 2007). The main purpose of early involvement is to involve different stakeholders early in the project to form project objectives and the ways to reach them as an integrated team (Aapaoja et al. 2013a). Alhava et al. (2015) noted that early involvement of designers and specialists together with the customer helps in achieving shared understanding at the early phase of the design and Wikström et al. (2010) found that early involvement is one of the cornerstones for better value creation.

Purpose of the integrated project team is to combine different groups together to reach common goals (SFC 2003). Several scholars have noted that integrated project teams can help to reach project objectives better than fragmented project teams (e.g. Baiden et al. 2006; Khanzode & Senescu 2012; Aapaoja et al. 2013a; Ibrahim et al. 2013a). However, it is not an easy task (Dainty et al. 2001). For example, lack of commitment from customer's top management, lack of commitment from other parties and lack of trust are some of the biggest barriers to build an integrated project team (Rahman & Kumaraswamy 2008).

Aapaoja et al. (2013b) and Baiden et al. (2006) searched characteristics and dimensions of team integration from literature. Suprapto et al. (2015b) surveyed systematically how practitioners view team integration based on their experiences and gathered the most important elements from factors facilitating relational contracting from Rahman and Kumaraswamy (2008) and factors facilitating successful partnering from Black et al. (2000). The characteristics and elements that were most named and thus were considered most important from above-mentioned studies are compounded together and gathered into table 3.

Aapaoja et al. (2012) noted that many of the preconditions founded are connected to each other and by increasing one several others might be increased too, for example, mutual focus and objectives help to focus on problem solving and not solving who is guilty. Baiden et al. (2006) and Aapaoja et al. (2013b) noted that if project team does not fulfill any of the characteristics and elements they mentioned it could be called as completely fragmented project team and if project team fulfills entirely all the key characteristics and elements the project team could be described as fully integrated team. Teams and stakeholders can have several different levels of integration and teams

can be fully integrated, partially integrated or completely fragmented (Baiden et al. 2006; Baiden & Price 2011). Baiden et al. (2006) noted that none of the award-winning teams was fully integrated and perfect and complete team integration can never be achieved. On the other hand, none of the project teams were completely fragmented so all the teams were partially integrated with different amounts of integration (Baiden et al. 2006). Team can be successful without completing all the characteristics (Aapaoja et al. 2012). It is important to note that the larger the group the more important it is to align joint goals and develop commitment to them to avoid social problems and boost collective beliefs of efficacy and beliefs that collaboration has positive outcomes (Seijts & Latham 2000).

Table 3. Different characteristics and elements of successful team integration and collaboration.

Characteristics and elements	**Literature source**
Shared objectives and focus	Suprapto et al. (2015b); Hoezen (2012); Lahdenperä (2012); Laan et al. (2011); Lank (2006); Baiden et al. (2003); Anumba et al. (2002); Love and Gunasekaran (1998); Evbuomwan and Anumba (1998)
No blame culture	Suprapto et al. (2015b); Ross (2003); Vyse (2001); Bromley et al. (2003); Dainty et al. (2001); Evbuomwan and Anumba (1998)
Team support each other and results are mutually beneficial	SFC (2003); Baiden et al. (2003); Dainty et al. (2001); Vyse (2001); Love and Gunasekaran (1998); Fleming and Koppelman (1996)
No restrictions in information sharing	Hoezen (2012); Bromley et al. (2003); Moore and Dainty (2001); Vyse (2001); Cornick and Mather (1999); Evbuomwan and Anumba (1998)
Every team member has equal opportunity to contribute	Lahdenperä (2012); Baiden et al. (2003); Bromley et al. (2003); Moore and Dainty (2001); Love and Gunasekaran (1998)
Increased predictability of overall costs and schedule	Hoezen (2012); Baiden et al. (2003); Anumba et al. (2002); Cornick and Mather (1999); Evbuomwan and Anumba (1998)
Teamworking spirit and respectful atmosphere	Lahdenperä (2012); Hoezen (2012); Rahman and Kumaraswamy (2008); Dainty et al. (2001); Moore and Dainty (2001)
Flexibility to change	Baiden et al. (2003); Anumba et al. (2002); Black et al. (2000); Evbuomwan and Anumba (1998)
Organizational boundaries ignored	SFC (2003); Bromley et al. (2003); Vyse (2001); Fleming and Koppelman (1996)
Mutual location	SFC (2003); Dainty et al. (2001); Bromley et al. (2003)
Risk sharing defined and risk shared together	Lahdenperä (2012); Rahman and Kumaraswamy (2008); Ross (2003)
Commitment of top management and commitment between parties	Suprapto et al. (2015b); Rahman and Kumaraswamy (2008); Black et al. (2000)

Baiden et al. (2006) defined three different levels of team integration: fully integrated, partially integrated or completely fragmented and set criteria for defining how integrated project teams are. Criteria includes definitions for full achievement, partial

achievement and no achievement in different dimensions of integration. Full achievement requires same focus and objectives of all parties, single project team with constant co-location, no boundaries at all and very high levels of trust and information sharing for example and no achievement is a total opposite for that. Partial achievement requires that individual objectives are in line with project objectives, project sub teams are co-located, boundaries are low and there is high levels of trust and information sharing for example. (Baiden et al. 2006)

Suprapto et al. (2015a) found three factors that lead to good team working quality in capital projects: relational attitudes, collaborative practices and teams' joint capability to maintain collaboration. Relational attitudes including mutual trust, no-blame-culture, commitment and openness in the permanent organizational level between top management of project owner and contractor are essential because they create the foundation for teamworking. On the project level, collaborative practices such as team building, formal team integration and joint risk management in the early phases of the project launch the teamworking processes. Finally, to ensure effective teamworking during the project, project managers should take care of good communication, coordination, mutual support, aligned effort, trust building, cohesion and balanced contribution. (Suprapto et al. 2015a) In the project environment, relational attitudes and trust have been seen stronger incentives than financial incentives (Suprapto et al. 2015b; Rahman & Kumaraswamy 2008).

Aapaoja et al. (2013b) divided key characteristics of team integration they identified into four cornerstones for creating an integrated team: IPD process well known, cultural change, early involvement and assessment and communication and interaction. The cornerstones and the most important characteristics clarifying the meaning and purpose of each cornerstone are presented in figure 7.

Early involvement and assessment targets to create a pool of knowledge that can be used to maximizing value creation. Communication and interaction are essential for building trust and to coordination of the project. Together early involvement and communication and interaction help the project to find the most capable stakeholders and negotiate project purposes. Proper and early understanding of stakeholder needs and requirements help to generate and choose the best solutions for value creation. Cultural change means actions to get rid of old habits and practices and to enhance commitment

to mutual objectives and best for the project decisions so that stakeholders win or lose together. However, cultural change is possible only with good knowledge of IPD process because contractual terms, collective responsibilities and transparency differ between IPD and traditional project delivery methods and incentives help change the old habits because financial factors have an important role in IPD projects too. (Aapaoja et al. 2013b)

Stakeholders should be involved as early as possible in order to make the integration deeper and maximize the value creation (Aapaoja et al. 2013a and 2013b). On the other hand, Aapaoja et al. (2013a) noted that projects contain different levels of stakeholders and they should be managed, coordinated and involved differently depending on their salience. Aapaoja and Haapasalo (2014) noted that it is not possible to involve all stakeholders similarly because of different constraints and stakeholders different roles and responsibilities. For that reason, they suggest a framework for stakeholder identification and classification that can help by systematizing the involvement process.

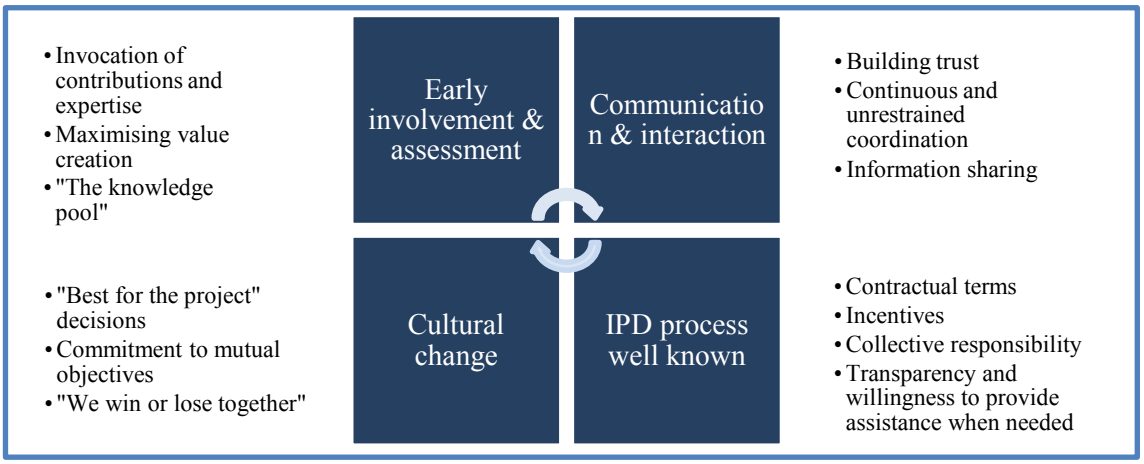

Figure 7. The cornerstones for creating an integrated team (modified from Aapaoja et al. 2013b).

2.4 Theoretical synthesis

The goal of the literature review was to find cornerstones of analyzing stakeholder importance and the level of collaboration in IPD. It covers three topics, which are inter-organizational integration, stakeholder management and level of collaboration. This

chapter aims to present the key findings from the literature and to synthesize the different parts of the literature review.

Inter-organizational integration as a phenomenon and different integration mechanisms including role of the collaborative working spaces like Big Room were studied to gather understanding about integration and to find reasons why stakeholders should be integrated. Stakeholder management theories and methods were studied to find different frameworks and models to analyze stakeholders. Identified models and frameworks can be used in formation of different levels for stakeholders, in stakeholder organization on these different levels and in definition of how different levels should be involved in the collaboration. Level of collaboration including collaborative process and identity and preconditions for team integration and collaboration was researched to find means how to achieve collaboration and team integration and what kind of different levels of integration there can be.

There have been many studies related to the integration from organizational point of view but inter-organizational context has recently become also important and the use of the integration mechanisms is widely noted to be one of the central issues in project management (Hietajärvi et al. 2017a). In industrial investment projects, there can be a lot of uncertainty meaning a lack of information and equivocality meaning ambiguity and multiple and maybe conflicting interpretations and integration is seen as a way to reduce them (Pekkinen & Kujala 2014). Contractual, organizational and technological integration mechanisms are important for achieving efficient collaboration. However, especially organizational integration mechanisms like for example Big Room including both formal and informal means that intend to integrate people are highly important for creating an integrated team. Organizational integration helps, for example, to increase open communication, social interaction and mutual trust and to enhance no-blame-culture and best-for-the-project-mindset, which enhances the collaboration and project performance. (Aapaoja et al. 2013b; Hietajärvi et al. 2017a; Walker et al. 2017; Aaltonen & Turkulainen 2018)

There are both narrow and broad definitions of stakeholders and the narrower definitions highlight the fact that an individual or organization should have a stake or an interest towards a project so that it can be called project stakeholder (Aaltonen & Kujala 2010). From the integration and collaboration point of view, the narrow definition is

better because stakeholders that form the integrated team and are involved in the collaboration have to contribute and to provide insights to the project so they have to have a stake or an interest toward a project (Aapaoja et al. 2013a).

Stakeholder early involvement in the collaboration with different integration mechanisms helps to conduct a more successful project with better value creation (Wikström et al. 2010; Aapaoja et al. 2013a) because it helps to achieve shared understanding earlier in the design (Alhava et al. 2015). However, not every stakeholder that has a stake or an interest towards a project should be involved (Aapaoja et al. 2013a). Thus, process that aims to identify, classify and prioritize stakeholders such as model for organizing stakeholders is needed. It is beneficial to involve stakeholders according to their importance in the project, which is affected mainly due to their capability to make an impact and the level of impact they can make. (Razali & Anwar 2011; Aapaoja & Haapasalo 2014)

Different methods and tools are developed to enable stakeholder organization into different collaboration levels (e.g. Aapaoja, et al. 2013a; Aapaoja & Haapasalo 2014). Stakeholders can be assessed based on their salience level in the project and their probability to impact and ability to contribute to the project (Aapaoja & Haapasalo 2014). Stakeholder salience consists of power, legitimate and urgency (Mitchell et al. 1997) but salience can also be understood as the level of impact the stakeholder can make (Olander 2007). Aapaoja and Haapasalo (2014) presented the stakeholder identification and classification framework that classifies and organizes stakeholders into four levels: PTM, KSP, tertiary stakeholders and extended stakeholders. The classification is done based on the definition of the project purpose and customer constraints, the identification of stakeholders according to their functional roles and the stakeholder salience and probability to impact/ability to contribute assessment (Aapaoja & Haapasalo 2014).

Different levels with different importance and functional roles should be integrated into the project in the different phases and have different requirements to participate in the collaborative process (Aapaoja et al. 2012; Aapaoja & Haapasalo 2014). In addition, the level of collaboration can vary from open market negotiation to the deep collaboration but the more there is integration between participants the more trust, commitment and resources are needed (Laiho 2015, p. 32). It is important to notice the role of the

stakeholders and to evaluate their importance so that stakeholder involvement can be done optimally. Figure 8 presents the theoretical synthesis.

Figure 8. Theoretical synthesis.

3 EMPIRICAL RESEARCH

3.1 Industrial investment project

The empirical research of this study is done in the research project, which includes many companies operating locally and internationally. The research project aims to develop new collaborative project management methods for industrial investment projects' development, design, engineering, implementation and management. The empirical research is made mostly within a case project conducted by one company involved in the research project but data gathering happened also in a workshop with participants from other companies participating the research project.

Industrial investment projects similar to large engineering projects are enormous and usually complex entities and their effects can be seen after many years (Miller & Lessard 2000). Investment project refers to a project that aims to develop company's own business and on the other hand, the same project is delivery project for the suppliers and contractors of the investor. The most common phase division in investment project lifecycle includes investment preparation, project execution and operations phases (Turner 1999).

Typically, project phases are divided into more specific sub phases with clear objectives to be achieved before next sub phase or phase can be started. One description of the investment project includes ideation and preparation of investment, project start and specification, planning, implementation, closing and product usage or product support phases. Project-specific phases depend on the project, its work breakdown structure and activity specification. (Artto et al. 2011) Industrial investment project includes above-mentioned phases but in slightly different forms. An example of a general industrial investment project structure with EPCM consultant contractor from Lehtinen (2019) is presented in figure 9.

Figure 9. General project phases in industrial investment project with EPCM model.

Industrial investment project includes development and implementation phases and production after the successful start-up. These phases are divided into parts that are more specific. Development phase includes tasks like concept, basic and detail design and project implementation phase includes engineering, procurements, construction and commissioning and qualification. (Lehtinen 2019)

3.1.1 The case project

The case project of this study is a large multinational investment project, which was on the development phase at the time of the study. Project was a greenfield project and the project goal was to build a metal product factory with unique solution that uses raw material used never before for that purpose. Greenfield project means that the development is started from scratch (Johnson et al. 2008, p. 311). For example, a project is a greenfield project when the factory is built in an empty plot. Nowadays, the most widely used investment implementation concept is EPCM-concept and there was an EPCM consultant in the case project too. For that reason, in this study industrial investment projects are studied only from the perspective that EPCM consultant is included. However, even without an EPCM consultant some other stakeholder or stakeholders have the same responsibilities that an EPCM consultant has in EPCM-concept. Responsibilities of the EPCM consultant include taking care of the

engineering, design, coordination and site management of the project on behalf of the project customer. EPCM consultant follows the budget and schedule set by the customer (Pöyry 2019; Lehtinen 2019).

In the case project, phase division and objectives of these phases were similar than it is presented in figure 9. However, there were minor differences and the phase division used by the EPCM consultant in the case project is presented in figure 10. The same division is used in the empirical studies, which helped in achieving mutual understanding with participants involved in the study.

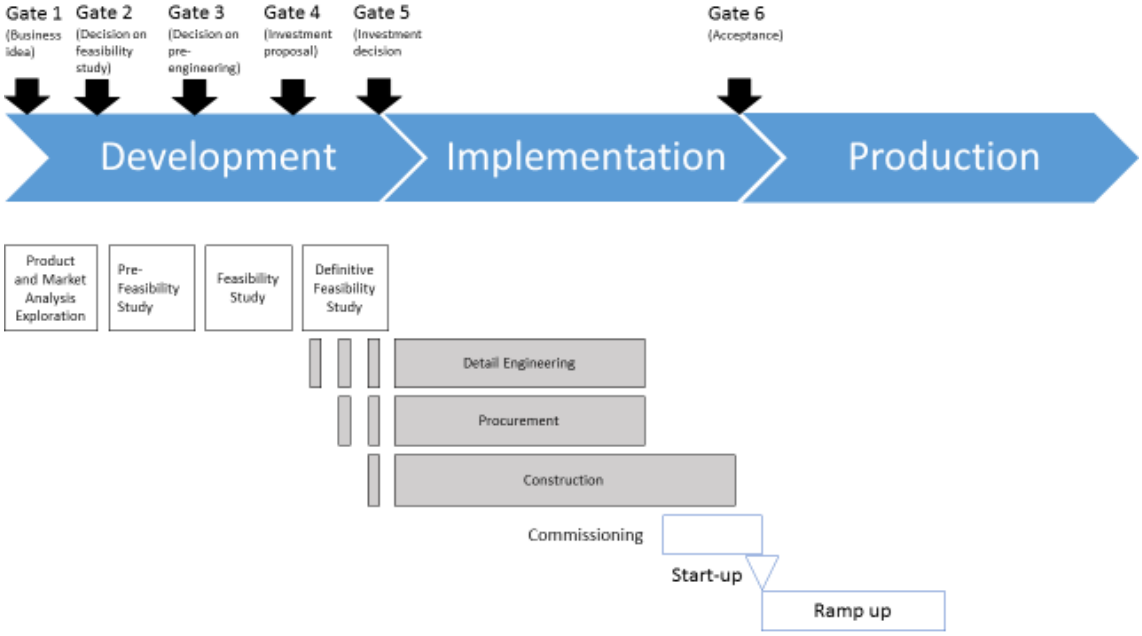

Figure 10. Project phase division in the case project.

Project development is divided into four phases and before product and market analysis exploration and after every phase, there is a gate where project owner and customer, called later in this study only as the customer, decide about continuing the project. Project implementation and construction start after final investment decision in definitive feasibility study, but detail engineering and procurement preparations are started already in the project development. When the construction works are ready commissioning can be finalized and start-up done. Then end product is evaluated and accepted if objectives are fulfilled and production can be started. Next chapter describes the objectives of the industrial investment project's phases more precisely.

3.1.2 The objectives of the project phases in industrial investment project

The lifecycle of the industrial investment project starts by product and market analysis exploration and continues to the full production stage. Depending on the end product, the operations continue for a long time, for example operations of a new plant may continue for decades. However, most of the significant decisions that affect massively the lifecycle and operations of the plant are made in the beginning of the project.

In pre-feasibility study similar to concept design phase, the objective is to identify and analyze the investment options and to transform the objectives of the customer into technical designs. However, technical design is not in the specific level yet. Other objectives include rough estimations of timetable and costs. (Lehtinen 2019) The project customer with the help of EPCM consultant estimates the costs with about 30% accuracy in pre-feasibility study phase.

In feasibility study similar to basic design, project customer together with the EPCM consultant continues the engineering and design tasks at a more detailed level with the objective to ensure the technical feasibility. In the end of feasibility study, the investment suggestion should be ready usually with about 20% cost accuracy. A goal of the definitive feasibility study as well as detail design is to finalize the upper level techno-economical entity and to form the final investment decision suggestion usually with about 10% cost accuracy. (Lehtinen 2019)

In detail engineering phase similar with engineering management phase, the design and engineering plans and the project schedule are finalized under the lead of EPCM consultant. The cost accuracy should already be calculated with few percent accuracy. Detail engineering phase starts parallel with feasibility and definitive feasibility studies and continues after investment decision. It creates a foundation for procurement and construction phases. (Lehtinen 2019)

Procurement phase starts in parallel with feasibility and definitive feasibility studies and detail engineering and it includes procurement planning and control, requirements documentation and supplier evaluation and later in implementation phase awarding of contracts and contract control. Procurement is done by project customer but in close collaboration with EPCM, which guides, supervises and checks the deliveries. (Lehtinen 2019)

Construction management includes construction and installation tasks like delivery control and site management. Site management team is responsible for the practical implementation of the project. The number of stakeholders and the amount of complexity increase greatly in the project implementation and the good coordination of activities is very important and it is the responsibility of the EPCM consultant. Plans for construction and installations are prepared already in the design phases so involvement of construction supervisors and safety coordinators et cetera into designing is important. (Lehtinen 2019)

Commissioning includes ensuring the work of earlier phases and inspecting and testing the plant that the results meet the agreed scope and technical requirements. After the commissioning, process can be started and ramped up and when the plant is accepted, the project is over and production phase can be started. The project customer makes the final acceptance of the delivery. (Lehtinen 2019)

3.2 Data collection

The empirical research was conducted by observation studies and a participatory workshop. Observation studies were conducted in an industrial investment project's project management team called owner's engineering team (OE team) meetings and in the first Big Room sessions. These Big Room sessions were arranged in the supplier collaboration session and they included the most important stakeholders of the project. The workshop was arranged to get knowhow from various industrial experts from different companies. Empirical data collection process is described in this chapter.

Observation studies

Several researchers did observations and the gathered data were compiled together afterwards. Observation sessions were conducted in OE team's weekly meetings in the development phase of the industrial investment project and in the supplier collaboration session of that same project. In total, approximately 20 hours of weekly meetings and a whole supplier collaboration session that lasted five days were observed. Observations of weekly meetings were external by nature, yet informal discussions took place before and after meetings. Observation of supplier collaboration session was participatory by nature, so researchers took part of the process and exchanged ideas with participants.

Observation of weekly meetings aimed to increase the researchers' understanding of the case project and to give valuable information about reasons why and how stakeholders should be involved and how collaborative methods can benefit that type of projects. Whole OE team participated to these weekly meetings face-to-face or virtually. They represented all the main disciplines of the project including for example time and cost control, construction, material handling, procurement and process technology. Manager of the team had at the same time responsibility over the whole project. OE team's purpose in the investment project is to take care of the big lines and to perform project monitoring on behalf of the project investor meaning the customer of the project. In other words, the OE team represents the customer. The agendas of the meetings were to check over past tasks and meetings held by each member, assign responsibilities and new tasks and discuss about identified problems and other upcoming issues.

Participatory observation of supplier collaboration session aimed to increase the understanding of how the use of collaborative methods can be started in practice and to observe how different stakeholders participate and on the other hand can be involved and how. During observations, researchers took notes and discussed with participants informally to get opinions on the methods and tools used and to ask how different stakeholders should be involved according to the stakeholders themselves. Supplier collaboration session was arranged in the late development phase of the project a few weeks before project implementation phase was intended to be started.

Workshop

During research project, a workshop that was about stakeholder integration and involvement was arranged. In the workshop, industrial experts were asked to name different stakeholders or stakeholder groups that should be involved in a certain project phase. Stakeholders was supposed to be named according to their generic roles and responsibilities in the generic industrial investment project. In addition, they were asked to tell a reason why that stakeholder or stakeholder group should be involved and what its main contribution in that project phase should be. Experts were also asked to identify reasons why stakeholder would like to participate to certain project phase and what could be the motivation behind it.

Several researchers participated to the workshop, some of them also participated to the workshop activities, and some of them only observed and wrote notes. During the

workshop, a wall including project phases was filled with identified stakeholders. In addition to stakeholders, their main contribution and reason to be involved or motivation to get involved was listed. On vertical axis of the wall, there were project phases from product and market analysis to production. The phase division was adopted from the same case project as in the observation studies because it was familiar for everyone and objectives of each phase were easy to explain for participants. Then the workshop was as realistic as possible and it was easier to get the participants to respond with examples from practical experiences. On the horizontal axis, stakeholder groups were presented with initial hierarchy levels including:

- level 1 project owner and customer
- level 2 EPCM consultant
- level 3 OEMs, infrastructure and construction contractors and system suppliers
- level 4 subcontractors
- level 5 product, resource and service providers

Initial hierarchy levels were adopted from Aapaoja et al. (2013a) and Statsenko et al. (2018). The wall used in the workshop is presented in figure 11.

Project phase							
Production							
Ramp up							
Start-up							
Commissioning							
Construction							
Procurement							
Detail engineering							
Definitive feasibility study							
Feasibility study							
Pre-feasibility study							
Product and market analysis exploration							
	Level 1: Project Owner and customer	Level 2: EPCM consultant	Level 3: OEMs	Level 3: System suppliers	Level 3: Infrastructure and construction contractors	Level 4: Subcontractors	Level 5: Product, resource and service providers

Figure 11. Project phases and stakeholder levels.

3.3 Analysis

The theoretical research emphasized the importance of early stakeholder involvement and collaboration. The aim of the empirical research is to find empirical evidence about needs for stakeholder involvement in the collaboration and means of how it should be done. An important aspect is to find out which stakeholders should be involved and in which project phases and why they would like to participate.

3.3.1 The need for stakeholder involvement

Observations of the weekly meetings revealed that in the case project there were roughly the same stakeholder groups presented than in the tiered procurement structure of the mining supply chain presented by Statsenko et al. (2018). Important stakeholder groups involved in the development phase in addition to project customer were EPCM consultant, a few original equipment manufacturers, one or two system suppliers, construction and infrastructure contractor and some subcontractors and product, resource and service providers. Later in the implementation phase when the work is in progress the number of stakeholders will increase and a big number of subcontractors and product, resource and service providers will be involved.

Members of the OE team had constant interaction with EPCM consultant's discipline managers and with representatives of OEMs, system suppliers like for example automation system supplier and infrastructure and construction contractor. Already in the development phase of the project, the amount of information that had to be compounded from different stakeholders and activities that had to be coordinated was great. Team members highlighted that the interaction was too bilateral, and it took place for example between OE team's discipline manager and the counterpart from EPCM consultant's team or between discipline manager of OE team and contact person from one OEM. One team member noted that: *"There are problems with the flow of information and the information conveying by memos do not work optimally."* According to OE team bilateral interaction and invalid and too slow flow of information were problems because important issues affecting the whole project should be discussed together as soon as possible and if not, and then there is a risk that information does not reach the one who needs it on time and it affects problems.

OE team members noticed a problem that stakeholders used their own systems and even some of the stakeholders that had instructions to use the system introduced for the project did that. For example, all the documents were supposed to be transmitted though project bank. One team member admitted that: *"Some of the files and work progress reports have been sent through e-mails."* Team decided, that in the future files that have been not sent through defined system are not noted to be received because it was difficult to keep updated with the latest information and design solutions and decisions made. Different groups also used different terms for the same issue and project milestones and objectives were not clear for every stakeholder so there existed equivocality. Many of the OE team members noted that the use of different collaborative methods and tools depends about contracts the suppliers, contractors and subcontractors have. For that reason, there was a clause about involvement in collaboration in the preliminary contracts considering the late development phase and plan was to put a similar kind of clause into the actual contract.

It was obvious for the OE team that the more stakeholders participating to the design and engineering of the project the better chances there are to conduct a successful project with less uncertainty, unexpected problems and schedule delays. According to them stakeholder participation to development phase helps for example in making a better work-breakdown structure because different constraints can be noticed easier and the duration of the announced or estimated work phases can be better defined. In addition, it is very usual that OEMs, system suppliers and different contractors add some schedule buffers in their estimations and when every stakeholder does that, but the durations of the buffers are unknown there is a lot uncertainty in the scheduling. OE team agreed that: "*Sitting at the same table, socialization and joint discussions with the key stakeholders support in finding a common vision and bringing up the potential problems and opportunities when noted."* OE team decided to organize a supplier collaboration session in the late development phase of the project before project implementation for above-mentioned reasons. Other aim was to get to know each other and to create social relationships that supports the project implementation phase. It was named supplier collaboration session instead of the stakeholder collaboration session because most of the important stakeholders in the industrial investment projects that should be involved in the collaboration are different suppliers.

3.3.2 How to involve stakeholders and to start collaboration

It has to be noted that stakeholder involvement is different in different project phases. In project development, it is more related to finding new, innovative and better solutions through collaboration of different parties with different expertise areas in engineering and design tasks. It is also important to create inter-organizational relationships and mutual trust that help in the project implementation when problems occur. In project implementation, the involvement is different because parties conducting the project have already contracts and tasks are conducted according to the plans. Then collaboration is more like conducting tasks and solving problems together and there is not as much room for innovation and changes as there is in the development phase.

Aim of the participatory observation conducted in supplier collaboration session was to observe how the integration of different stakeholders takes place in practice and what issues stakeholders bring up during the week. In addition, information from the session helps to assess different stakeholders, to decide which stakeholders should be involved and when and by which method.

Agenda of the session was prescribed by OE team and was sent to participants before session. The objectives for the session were to align project scheduling targets, to produce plans with those who will do the work, to reveal and remove constraints on planned tasks, to review the master schedule and to define the key milestones for the mill area in scheduling workshops collaboratively. Other objectives for the week were to get to know each other, to understand better Lean tools especially Last Planner System and the scheduling principles for the project and to define information release schedule so that construction works can be started on time.

During the week, there was introduction to the project and its details, Lean and Last Planner training, workshops for construction, commission and information release schedules, reviewing the results of workshops and risks related to the project and many discussions focusing on certain disciplines or process areas in smaller groups. Asked attendees for the supplier collaboration session were project managers, site supervisors, commissioning managers et cetera with the requirements to be able to estimate the length of their own organization’s activities and to do sequencing for the different project phases. Invited and participated stakeholders included:

- Owner engineering team members
- ECPM consultant (with members from all project disciplines)
- All Original Equipment Manufacturers
- Automation system supplier
- Electrification and instrumentation supplier
- Infrastructure and construction contractor
- Construction subcontractor
- External consultants to educate and instruct Lean and Last Planner principles and to facilitate the workshops

In workshops real and clear progress was reached, for example, information release schedule related to preliminary data for construction start was agreed and many risks related to carrying out the project were noted and discussed. During the workshops, there were many discussions related to project objectives and terms and common language to be used in the project. Thus, now everyone who participated understands better what the project objectives are and what is meant by certain terms and they can share the information in their own organizations. It can help to reduce risks of misunderstandings in virtual context, for example. In the end of the session, the project manager noted that: *"Now there are more known unknowns than unknown unknowns than before this session."*

Every participant participated actively, which led to good and open atmosphere and socialization and informal relations were created or existing ones deepened. Lean consultant noted that: *"The atmosphere is open, and many problems related to project schedules have been noted and tried to be solved together."* Participants highlighted the fact that collaboration and best-for-the-project-mindset is easy now, but the situation is different when hard situations and problems take place. However, they all agreed that during the week, there was an open and collaborative atmosphere and some mutual trust was generated, and it will be beneficial in the implementation phase. They also agreed that informal relations help in communication and after getting acquainted people dare to speak about problems easier. Participants agreed and decided that: *"Discipline leaders from the supplier side should already attend to weekly discipline meetings held by the EPCM."*

Participants had only limited experience of collaborative practices and they had to orientate themselves for new methods and tools. There occurred some change resistance towards the new ways of working that were planned for the project. Some participants noted that: *"The traditional scheduling principles are good, and everyone are familiar with them so what is the reason to change the working style."* Therefore, it needs more practicing to appreciate and understand the suitability of the new methods and tools and to be able to use them in an effective way. In addition, all agreed that there should not be too many new methods and tools, which will be introduced for the project. The suitable number of the new methods and tools was discussed to be from three to five.

During the first scheduling workshop, participants were divided into two groups for practical reasons. One group scheduled the main tasks between key milestones for construction of buildings and the other for process areas. The division led to handling interlocked issues separately and these two schedules were not easy to combine later, and it required time. One participant noted that: *"In the beginning, the scheduling was started from the start towards the end even it should have been oppositely."* Because of the above-mentioned issues, the time may not have been used efficiently to solve the most relevant problems during the week. In addition, during workshops occurred discussions that were important for only a small group that were conducted with too many people and then the interest of unnecessary people decreased quickly.

The weakness of the session was that not all important stakeholders were involved. For example, some subcontractors essential for scheduling certain equipment installations or piping were not presented because they were not tendered yet. Participants implicated that these important stakeholders should be involved one way or another before the binding engineering and design solutions and project schedules and plans are done because their expertise is needed when there is still possibility to make changes easier and cheaper. The OE team declared that: *"The important subcontractors are aimed to get involved as soon as possible."*

3.3.3 Which stakeholders should be involved

It is important to find the right stakeholders to be involved in the collaboration. This chapter aims to analyze the empirical data and to find the important stakeholders to be involved for different project phases. Before the workshop arranged for the experts, it

was obvious that the project customer should be involved practically in every phase of the project at least indirectly and the workshop confirmed that preconception.

In the product and market analysis exploration in addition to the customer, OEMs could be involved because understanding the potential of available technology is very important and it affects the investment decisions. The OEMs are more important when the project goal is to build a completely new kind of solution with new technology for example a plant with fuel or raw material that is never used before instead of a solution that has been tested before. With a new solution research and development is needed before the actual project development and especially the presence of OEMs but also maybe system suppliers is beneficial and co-operating with them helps to create a working solution.

EPCM consulting company or companies should be involved in the pre-feasibility study to start the concept and basic design. In addition to the project customer and EPCM, other important stakeholders for the pre-feasibility study depends on different issues. Experts agreed that: *"OEMs and system suppliers are important and should be involved if the technology and solutions are new and unique because they can help in the technology, cost, schedule, design and engineer solutions."* Involvement of infrastructure and construction contractors, subcontractors and product, resource and service providers are not usually needed in the pre-feasibility study.

EPCM consultant company should be chosen and of course involved in the feasibility study. Similarly, to the pre-feasibility study it is important that OEMs and system suppliers are involved if the technology and the solutions are new but even they are not OEMs and system suppliers should be involved because they are needed in the technical issues and project planning. For example, one expert noted in the workshop that: *"When the production line is designed it is more resource efficient to do it as a whole with all necessary stakeholders than to design every phase of the production line separately.*" The need for involvement and collaboration in feasibility study depends on EPCM consultant's role and capacity to make estimations about technical and economic issues. Different product, resource and service providers might be needed and involved to make for example measurements, but it depends on the project and resources of the EPCM consultant.

EPCM, OEMs, system suppliers and infrastructure and construction contractors should be involved in the definitive feasibility study. It might be useful to involve some subcontractors, but it depends on the capabilities the involved stakeholders already possess. In the late definitive feasibility study, the final investment decision is made, and involvement is important also in terms of building relationships because soon the project implementation starts, and deep collaboration is needed. One expert noted that: *"The role of the designer in this case EPCM is critical because it can decide to find new solutions with the help of others or to stay in more traditional way of working and to make major part of the design alone."*

It has to be noted that usually there are multiple EPCM consultant, OEM, system supplier and infrastructure and construction contractor options in the early phases of the project development and the customer evaluates options and chooses the EPCM consultancy company. After that project customer can choose the other suppliers and contractors with the help of the EPCM. However, involvement of these stakeholders is needed before the choices are made and the final contracts signed to make and help for example in the concept and process definitions. Competitive position helps to find the best solution and to keep the costs down and on the other hand to find the best cost and quality ratio.

At least OEMs, system suppliers and infrastructure and construction contractors should be involved in the detail engineering phase but in addition especially the subcontractors of them can be involved too if they have special expertise that is needed. They are experts in their own fields and they have knowledge and technical specifications of their supplies and work that are very useful in design and engineering tasks. However, the involvement of other stakeholders and their roles and responsibilities depend a lot about details in the contract between customer and EPCM consultant. One expert noted that: "*The supplier analysis should be carried out to find out what kind of expertise is needed, and which subcontractors and other suppliers possess it and should be involved in the planning*." In this case, supplier analysis means the same issue than stakeholder analysis in practice. For example, involvement of electrical, instrumentation and automation subcontractor can help to reduce design errors and to cut down the operating expenses (OPEX) by better solutions in maintainability.

In procurement phase, involvement of other stakeholders than EPCM and project customer to conduct procurements is not needed. On the other hand, other parties are the ones to be procured and the main contractors and suppliers sign a contract with the project customer after it has evaluated and chosen them with the help of EPCM. Experts agreed that suppliers and contractors do not want to form the alliance and make multiparty agreements with the project customer similarly than in construction projects because especially suppliers have high-technology equipment and they do not want to share their cost structures with others. In addition, investors might not be ready to abandon the bilateral contracts and allow the use of alliance contracts because of the opportunity and risk sharing practices, for example. In the construction phase, stakeholders that should be involved in the collaborative activities depend on the project and stakeholder analysis is needed to support the decisions about which stakeholders should be involved and when. The situation is similar in commissioning, start-up and ramp up phases so the stakeholder analysis is needed.

In the supplier collaboration session, participants agreed that infrastructure and construction contractor has very important role in the construction phase because it is responsible for construction works and it should be at the core of the collaboration. Similarly, involvement of its subcontractors is most probably very important. OEMs' and system suppliers' roles are not so important in the construction works and they focus more to supervision because they have already participated in the engineering phase where plans were made and processes were defined. OEMs' and system suppliers' importance increase again, when the installations start and role of the infrastructure and commissioning contractor's decreases.

3.3.4 Which stakeholders want to get involved

In the product and market analysis exploration, OEMs usually want to get involved because they want to influence the choice of technology, which means that their solutions might be chosen instead of the competitors' solutions. Another reason to get involved for OEMs' is that they can get to know the project better and they can affect the other project decisions. OEMs can for example influence the technology selection process for their own benefit and on the other hand to ensure that the other choices are better compatible to their own equipment. In addition, companies offering design and engineering services like EPCM consulting companies most probably want to get involved early.

In pre-feasibility phase, it is necessary that EPCM consultant is involved but there might be still more bidders than one. OEMs and system suppliers want to get involved because they want to offer their technology and to strengthen their own positions. On the other hand, the information about competitors enhance the willingness to participate because companies want to get a contract. The situation is probably similar in the feasibility study phase. In the definitive feasibility study phase, there are probably more stakeholders willing to participate and to take part of the basic engineering for example. Experts stated that: *"OEMs, system suppliers and infrastructure and construction contractors want to get involved to the definitive feasibility studies because then they can reduce their own risks and uncertainties related to the project schedule and design and engineering solutions."* In addition, it is beneficial for the stakeholders if there exists less equivocality in the project and for example, project milestones and terms used are clear. If the project is wanted to be conducted collaboratively, it is important to note stakeholders' willingness for the use of collaborative methods and tools in the early phases of the project.

In detail engineering phase, above-mentioned stakeholders want to get involved with the same reasons and subcontractors want to get involved because they want to make their own work easier and to reduce risks and uncertainties. They can make their own work easier by influencing design and engineering solutions and ensuring that plans and schedules are feasible. For example, one expert noted that: *"When the subcontractors, whose responsibilities in the project are related to building solutions and balance of plant, can take part of the engineering and design they can help in creating more innovative and better solutions through their earlier experiences. Their expertise can help to enhance constructability and to reduce the need for change orders in implementation phase."*

In the EPCM project implementation model, project customer has the responsibility for procurements and EPCM consultant provides assistance. Stakeholder involvement and collaborative activities are not needed in procurements. Other stakeholders are involved only as a potential suppliers and contractors with the aim to get a contract.

In the construction phase, there are more subcontractors and product, service and resource providers than in the development phase that are worthwhile to be involved in the collaborative activities like for example collaborative scheduling with Last Planner

System (LPS), inter-organizational meetings in Big Room and innovating better solutions through the innovation system but they have to be motivated. Experts mentioned that: *"Stakeholders might want to participate because involvement helps in understanding the others' work better, it helps to find synergy benefits and to solve problems when they occur faster and more effectively.*" In addition, motivating factors like possibility to be included in the bonus model and to get incentives and better occupational safety and predictability can enhance the willingness to participate and "to do more" for example by taking part of the collaborative meetings in Big Room, to share information and to work with best-for-project-mindset.

3.3.5 What are the cornerstones of stakeholders' organization on different levels

In the workshop, stakeholders were organized initially into five levels but from the collaboration point of view it is not necessary to have own levels for project customer and EPCM consultant. EPCM consultant and project customer work in close collaboration in every case and EPCM consultant carries the tasks on behalf of the customer. Thus, they should be on the highest level of collaboration together but EPCM's role is to be responsible for the work and OE team's role is to supervise.

OEMs are very important in the project development and detail engineering phase and they should be in the highest levels of collaboration, but it seems that they are not so not important in the construction phase. However, their role is again more important in commissioning and start-up. It is important to continue information exchange and communication with OEMs throughout the project. Situation with system suppliers is quite similar than with the OEMs. Infrastructure and construction contractor's role is not so important in the beginning of the project but later it is more important, and they should be involved in the collaboration deeply in the detail engineering phase and after that. Organization of other stakeholders is harder and case specific.

3.3.6 Empirical synthesis

The goal of the empirical study was to find reasons why stakeholder involvement and collaboration are seen as important and which stakeholders were important and involved in the case project. This chapter aims to present the key findings and to synthesize the different parts of the empirical analysis.

In the case project, several reasons for stakeholder involvement were noted. There were a lot of activities to be conducted and information to be compounded from different sources and from different stakeholders in the development phase. Information exchange was not working optimally and it was hard to keep up with the latest information and design solutions and decisions made. It was known that different suppliers and contractors have schedule buffers with unknown lengths in their estimations. In addition, stakeholders used different terms, and project milestones and objectives were not clear for every key stakeholder. It was obvious for the OE team that stakeholder involvement, socialization and joint discussions help to find a common vision, to bring up the potential risks and opportunities when noted and to conduct a project with less equivocality, uncertainty, unexpected problems and schedule delays. In addition, the work-breakdown structure can be done better because different constraints can be noticed easier and project schedule can be estimated more accurately.

Stakeholder involvement varies between different project types and project phases. When project requires unique solutions, experienced stakeholders with needed competencies should be involved in project planning. In project development phase, stakeholder involvement helps to find new, more innovative and better solutions and plans and to create for example, inter-organizational relationships, best-for-the-project-mindset and mutual trust that help especially in the project implementation phase. In project implementation, stakeholder involvement helps to conduct tasks together and to identify and solve problems faster and better. It is important to start inter-organizational meetings in project development phase and to introduce practices, methods and tools that are planned to be used in the project so that the key stakeholders can participate in the defining of these practices, methods and tools. In addition, issues related to project schedules, milestones, goals, objectives and potential challenges should be discussed as early as possible with the key stakeholders.

Stakeholders that should be involved early depend on a project but in addition to project customer and EPCM consultant; OEMs, system suppliers and infrastructure and construction contractor have usually vital roles and are needed. There might be other important stakeholders to be involved early and stakeholder analysis is needed to reveal them. It is important to involve only needed stakeholders and to keep the focus in the right things at the right time so that the benefits of the involvement can be maximized and the costs minimized.

EPCM consultant wants to get involved early to affect the technology choices and other critical decisions in project planning and development. OEMs and system suppliers want to get involved in the pre-feasibility and feasibility studies to offer their own technology and strengthen their own positions. All the above-mentioned stakeholders and infrastructure and construction contractor want to get involved in the definitive feasibility study because they can reduce their own risks and uncertainty and equivocality related to the project plans, schedules and design and engineering solutions. In detail engineering phase, earlier mentioned stakeholders and some subcontractors want to get involved because they can for example, enhance constructability and reduce need for change orders and delays, which help them too. In project implementation phase, there are more subcontractors and product, resource and service providers willing to be involved because then they can understand others' work better, to find synergy benefits and to solve problems faster and more efficiently.

Project customer and EPCM should be organized always in the highest level of collaboration and their mutual coordination, collaboration and division of labor are important for the success of the whole project. OEMs and system suppliers are important especially in the project development, detail engineering, commissioning and start-up phases and they should be on the highest levels of the collaboration. Their role is not as important in the construction phase but it is valuable to continue information exchange and collaboration with them at the appropriate respect throughout the project. Infrastructure and construction contractor's role is essential in the project implementation and it is very important to involve them from detail engineering phase to the end of the project implementation. They should be organized on the highest level of the collaboration. The general organization of other stakeholders in industrial investment projects is more difficult and case specific and it requires stakeholder analysis and understanding about the details of the project. Empirical synthesis is presented in figure 12.

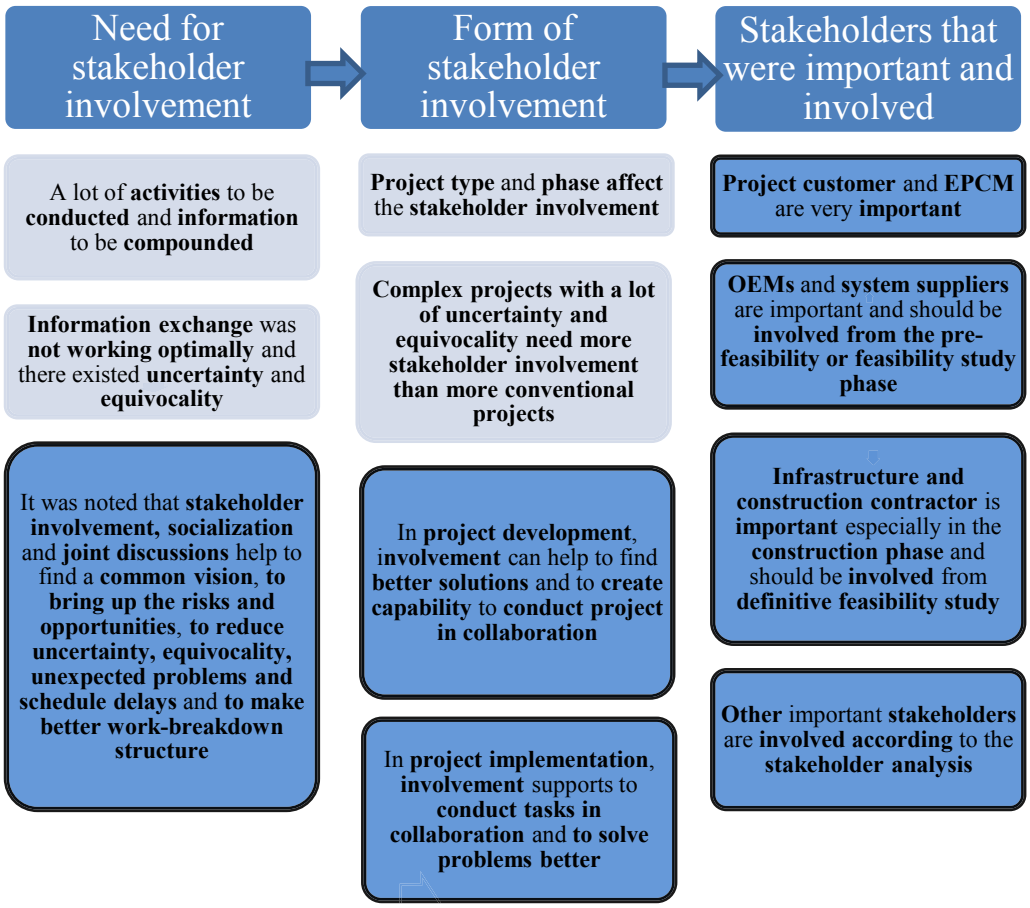

Figure 12. Empirical synthesis.

4 STAKEHOLDER ORGANIZATION MODEL

According to the literature review, stakeholder early involvement and inter-organizational integration and collaboration are seen as important ways to improve project performance and to decrease uncertainty and equivocality. Empirical analysis proved that stakeholder early involvement and collaboration are seen as important means in an industrial investment project but there are no guidelines of which stakeholders should be involved and when and by which methods and tools. It is obvious that the type of a project, its objectives and project phase affect the stakeholder involvement. When the project objective is to build something unique, more involvement is needed than in better-known projects even through projects have always some unique elements. Especially, in the early phases of the project stakeholder involvement and cooperative research development are needed when the objective is to build something new and unique because the feasibility of the idea has to be clarified.

Earlier in the study, the project phases were divided into development, implementation and production. Empirical results established that the need for collaboration is different between but also inside these phases, and stakeholder involvement should vary between project phases. The stakeholders that should be involved in the early development phase are easy to be find and the number of important stakeholders is not big. In the late development phase, after the project planning is ready, the design and engineering are going into level that is more detailed and the investment proposal is made, the number of important stakeholders that should be involved in collaboration increases. Empirical study pointed that most of the important and critical stakeholders in the industrial investment projects in addition to project customer and EPCM consultant are different suppliers.

In the early implementation phase, after the investment decision is made, and the construction works start, the number of stakeholders increases a lot and there can be hundreds of stakeholders involved in the project. However, not all stakeholders should be involved in the collaboration and both empirical and theoretical information urged to use the stakeholder analysis to support the stakeholder involvement. For above-mentioned reasons the use of stakeholder organization model has the most benefits in the definitive feasibility study after the investment proposal is made and engineering starts at a more detailed level.

Empirical analysis highlighted the fact that projects are different and the model has to be dynamic and adaptive that it can be used in different kinds of projects and it can help to involve the right stakeholders in the right way. It is important to note what are the main objectives of the project and what kind of decisions should be made and tasks to be conducted because type of these decisions and tasks affect the need for stakeholder involvement. Need for collaboration is different in different projects and the form of collaboration and involvement of stakeholders should differentiate based on the situation.

The model is based on the Aapaoja's and Haapasalo's (2014) framework for stakeholder identification and classification but the phases of the model differ slightly and there is an extra phase because the model is modified according to the empirical analysis to be better suitable for industrial investment projects. The model aims to help in stakeholder identification, evaluation and organization on different levels and in choosing the right integration mechanisms for each level. The goal of the model is to assist in creation of integrated project teams and to enable the collaboration in a way that maximizes the benefits with the lowest possible input.

The model combines elements from stakeholder management theories and integration mechanism literature to enable collaborative process and team integration. The model has five main phases:

- Defining the project objectives and overall need for collaboration
- Stakeholder identification
- Evaluation of stakeholder importance
- Stakeholder organization on different levels of collaboration
- Defining appropriate integration mechanisms and collaborative methods and tools for each level

The model including stakeholder levels is presented in figure 13. The stakeholder levels are similar than stakeholder classes in Aapaoja's and Haapasalo's (2014) framework. However, the stakeholder organization on these levels differ slightly when compared to the classification in Aapaoja's and Haapasalo's (2014) framework.

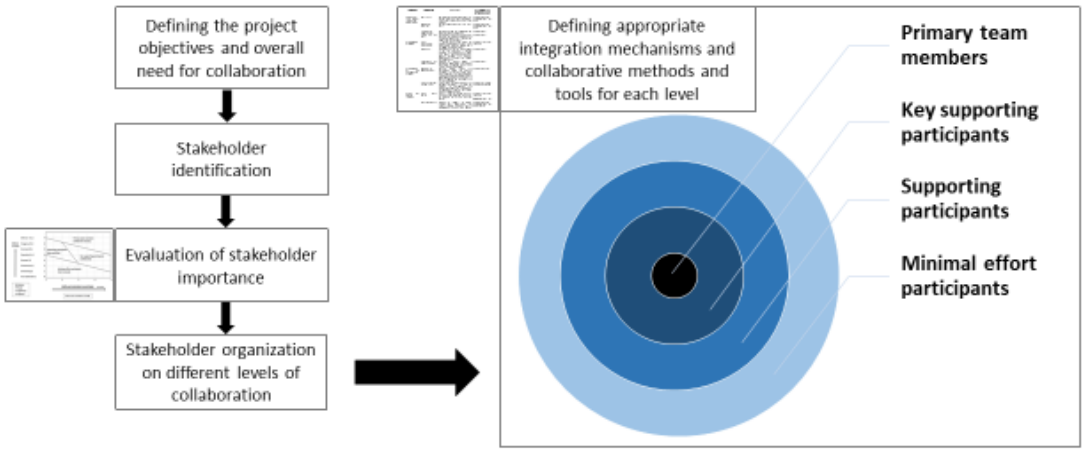

Figure 13. Stakeholder organization model.

The model is aimed to be used in the late development phase after the feasibility study when the project planning is ready, and the project plans, design and engineering are being brought to a more specific level and there are more important stakeholders that should be involved. The objective of the model is to support the stakeholder involvement in collaboration in the late project development and to support collaboration in detail engineering, construction, commissioning and start-up phases of the project when project include a lot of stakeholders. The main elements of the model and their contents are presented in the following chapters.

4.1 Defining the project objectives and overall need for collaboration

Projects have different objectives and they affect the need for collaboration because it is not advisable to conduct everything in collaboration. The results of the study stressed that appropriate level of integration is important and it varies between different projects. The collaboration can have different amount of benefits depending on the type of the project, project objectives, project's complexity level and the amount of different stakeholders in the project for example. In addition, it is important to understand what kind of interaction supports the achievement of objectives.

In the beginning of the project, opportunities, risks and expenses of the use of collaborative methods should be noted. Collaboration and involvement in it do not start

without contractual basis and common agreement of the ways to collaborate. For that reason, intention to use collaborative methods should be decided in the beginning of the project and already in the project planning, there should be discussions about it. The need for stakeholder involvement and its forms should be defined. Thus, four main questions for the project management can be set:

- What are the main objectives of the project
- What kind of interaction supports the achievement of objectives and the exchange of information
- How close collaboration is needed
- What are the objectives of the collaboration

According to the empirical analysis, it is important to note the main objectives of the project in the beginning because they affect the collaboration also. Then, it is important to note that what kind of interaction support the achievement of objectives and what kind of information exchange is needed. The more uncertainty and equivocality in the project the more inter-organizational integration and collaboration are needed. The objectives of the collaboration should be defined. It is important because then the focus can be aimed to the right things.

4.2 Stakeholder identification

When the need for collaboration is defined, the next step is to identify stakeholders that should be involved. The empirical analysis emphasized that the target of stakeholder identification should be to find stakeholders that have a stake toward project so they can affect the project. For that reason, stakeholders who have important role or responsibilities in the project should be noted. Another important task is to identify stakeholders that have ability to contribute and probability to influence through important information, knowledge and capabilities related to the project. Six questions can be set to help to identify important stakeholders:

- Which stakeholders have important role
- Which stakeholders have the responsibility of what is intended to be done
- Which stakeholders have valuable information concerning the decisions that have to be done

- Which stakeholders possess important capabilities concerning the tasks that have to be conducted and can make the performance more effective through their participation
- Which stakeholders possess knowledge that is useful when the decisions have to be done or tasks to be conducted

Theoretical data highlighted the importance of identifying stakeholders according to their functional role so the stakeholders should be defined according to it. It is valuable to identify stakeholders with important role and critical and important tasks and responsibilities because their importance in the project is the highest. Empirical analysis stressed the fact that stakeholders, which are involved in the close collaboration should have key role in the project, ability to contribute and information and knowledge to be shared. If there are stakeholders with valuable information, they should be involved, or the information must be obtained from them otherwise. When stakeholder has needed capability or knowledge that is important in achieving objectives, it should be involved. If project management can identify a stakeholder, who can make performance better in some task it should be involved too.

4.3 Evaluation of stakeholder importance

Stakeholder identification helps to find the stakeholders that are important for the success of the project and have important roles and competencies. However, the theoretical study noted that the stakeholders have rarely similar abilities and motivation to contribute and their importance in the project varies. Empirical study highlighted the importance of the stakeholder analysis for the evaluation of the stakeholders. There has to be evaluation criteria for stakeholder organization that helps in choosing the right stakeholders to be involved in the collaboration.

Aapaoja's and Haapasalo's (2014) framework for stakeholder identification and classification includes a stakeholder assessment matrix. It exploits stakeholder salience attributes based on stakeholder salience model from Mitchell et al. (1997) and probability to impact / ability to contribute. Salience model is problematic in the collaboration context because it focuses mainly on the stakeholder claims and how the project management should give priority and pay attention to them. For this reason, the focus should be shifted from the traditional definition of salience that comprises

stakeholder claims and their prioritization to the stakeholder importance. Importance of stakeholders is due to the their capability to influence the project, their positions in the project, their resources, their capability to collaborate and their interests toward the project for example.

In addition, Aapaoja's and Haapasalo's (2014) framework is intended to construction projects and their case examples are health center construction project and buildings renovation project, which have different basis than industrial investment projects. Empirical analysis pointed that the ability to contribute is more important in the industrial investment projects than in the construction projects because there exists more need for special expertise and innovations to enable the realization of the project and to find solutions that have economic and technical feasibility. According to Aapaoja and Haapasalo (2014), stakeholder importance can be evaluated by defining how many salience attributes stakeholders' possess and what is their ability and motivation to contribute, and similar matrix is used in this study. Below, modified stakeholder salience attributes are described.

Stakeholder power means that stakeholder can enforce the outcomes it desires despite resistance and it can be utilitarian, coercive or normative (Mitchell et al. 1997). In this study, power means that the stakeholder can affect the project decisions through its large stake of the CAPEX usage, its position in the project is critical and it has important responsibilities and resources. When stakeholder's stake of the CAPEX is high, it has naturally more power in the project because its actions has great effect on the use of money and the project outcome. When stakeholder's position in the project is critical, its responsibilities are important for the success of the project, and stakeholder's actions affect greatly to the project and other stakeholders, it has power. Stakeholder's power through its resources can be noted for example, when there is a stakeholder with unique and best in the markets solution or a very important expertise. Then project management knows that its involvement in the project and for example getting its solution into use are important for project performance or project results.

Stakeholder legitimacy is based on justification of stakeholder actions and when stakeholder's actions are seen as proper, desirable and appropriate they possess legitimacy (Mitchell et al. 1997). In this study, legitimacy means that project management wants to involve legitimacy stakeholders, their actions and involvement

are seen as desired, and they are thought to be reliable. For example, a stakeholder has legitimacy if it possess good team players with co-operation skills and it can be foreseen that it acts in desirable and appropriate way. Legitimacy stakeholder has reliability and it is easy to build mutual trust with it.

Stakeholder urgency consists of time-sensitivity and critical importance and urgency means that stakeholder's interest is time-sensitivity and critically important (Mitchell et al. 1997). In this study, urgency means that stakeholder has much interest towards project and it wants to make an impact because its interest has time-sensitivity and project is critically important for it. When the project decisions and objectives are time-sensitive and critical, the stakeholder is more interested. For example, if a stakeholder demands that the project should be conducted with the schedule it wants and the decision about the schedule is critically important and time sensitive for that stakeholder, it possess urgency. Project schedule can be critically important for example because it affects stakeholder's use of resources and demand can be time-sensitive because possibility to influence the project schedule is usually at its highest at the beginning of the project.

Probability to impact/ability to contribute in Aapaoja's and Haapasalo's (2014) assessment matrix has slightly different description in this study. Probability to impact describes the stakeholder's willingness and motivation to participate. For example, different incentives like a bonus model, cost reimbursement and a better chance to get a contract can increase the probability to impact. For that reason, probability to impact can be called motivation to contribute. Ability to contribute is based on competencies meaning information, knowledge and capabilities the stakeholder has. Thus, x-axis is called ability and motivation to contribute.

Information means the important information that helps to fulfill the objectives and to make for example the process design, the equipment installations or the commissioning schedules better. For example, a technical information or specification can help in the process design. Knowledge cannot be shared easily and getting it into use requires social interaction and involvement of a person or people possessing it. If one stakeholder or its representative possess knowledge that is important for tasks and decisions going to be made, it would be beneficial to involve it. For example, earlier experiences can generate tacit knowledge what is very hard to share, and its utilization

requires social interaction and involvement of that experienced stakeholder or its representative. In this case, capabilities mean that the stakeholder contribution for example to the design or engineering has a significant value and it improves the performance. For example, when project management notices that the piping contractor has the capabilities to help in finding the best possible solutions that can enhance the project performance a lot, it is highly important to involve it deeply and early enough to support and help in engineering and design tasks. Then the engineering, design and scheduling of installations related to pipes can be done better.

Matrix presented in figure 14 can be used in evaluating stakeholder importance. It is a modification of the impact/probability matrix modified first by Olander (2007) and later Aapaoja and Haapasalo (2014). Its usage is quite similar than in stakeholder assessment matrix that Aapaoja and Haapasalo (2014) presented.

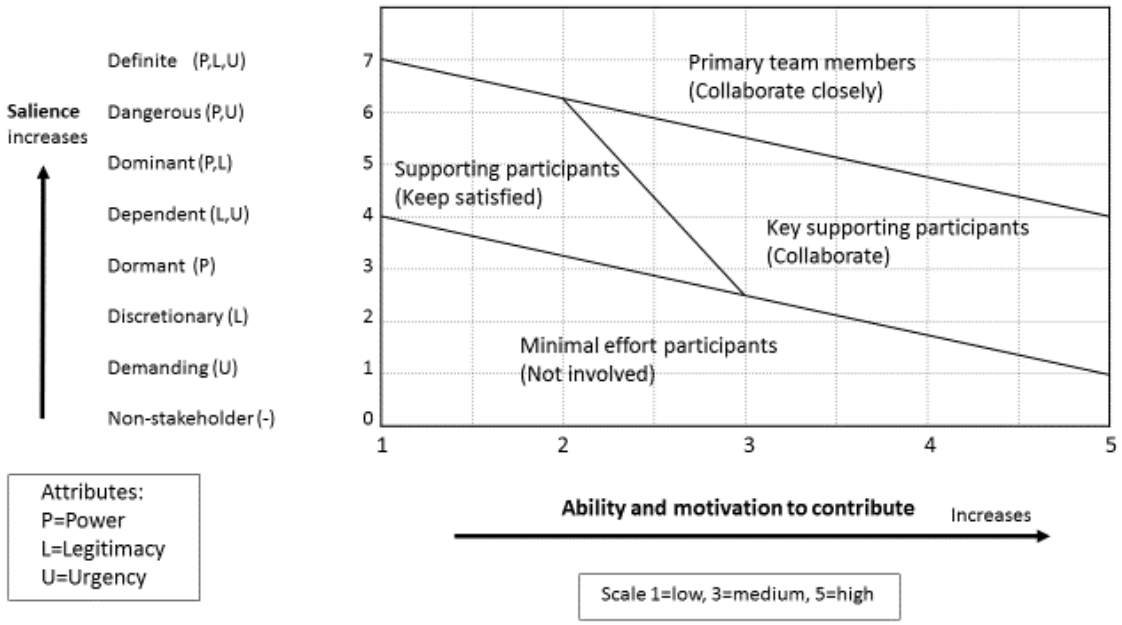

Figure 14. Stakeholder evaluation matrix.

Compared to the matrix Aapaoja and Haapasalo (2014) presented, the x-axis is different but the y-axis similar. Ability and motivation to contribute is evaluated based on information, knowledge, capabilities and motivation to be involved the stakeholders have. Salience is based on earlier descriptions about power, legitimacy and urgency. The stakeholder evaluation should be done for all identified stakeholders by project management.

Stakeholders possessing only one salience attribute and a low level of ability and motivation to contribute are not important for the project and they should not be involved in the collaboration, so they are in "not involved" level. Stakeholders possessing two salience attributes but a low level of ability and motivation to contribute or power and a moderate level of ability and motivation to contribute should be involved in the information exchange but not in the tight collaboration. They are moderately important but not needed in active and constant collaboration and joint working because their ability and motivation to contribute is quite low. They are in "keep satisfied" level and it might be useful to involve them in special cases when their presence and contribution is evaluated to be useful.

Stakeholders who possess more salience than "not involved" level and more ability and motivation to contribute than "keep satisfied" level are in the "collaborate" level. They possess a lot ability and motivation to contribute and one salience attribute or an average amount of ability and motivation to contribute and two salience attributes. They are important and should be involved in the collaboration. They should share their opinions and earlier experiences, ask questions and contribute to the project even their salience level is not evaluated to be very high. For example, with their help and involvement in innovation technical design can be done better.

Stakeholders possessing all three salience attributes or at least two salience attributes and a lot ability and motivation to contribute to the project should be in "collaborate closely" level because they are very important for the fulfillment of project objectives. They are the stakeholders having the most responsibilities, tasks, interests and valuable knowledge and capabilities in the project and they should form the project core group.

4.4 Stakeholders organization on different levels of collaboration

According on the earlier literature (e.g. Aapaoja & Haapasalo 2014; Olander 2007), the stakeholder levels in order of importance are as follows:

- Primary team members (PTM)
- Key supporting participants (KSP)
- Supporting participants (SP)
- Minimal effort participants (MEP)

PTMs are the stakeholders that should be in the closest level of collaboration and they should have the broadest requirements to participate and to use collaborative methods and tools. Project customer and EPCM after it is chosen are always PTMs. In addition, OEMs, infrastructure and construction contractors and system suppliers are probably PTMs. KSPs take part of the collaboration and have an important role, but their salience or ability and motivation to contribute is not as high as PTMs'. For example, they may not have power because their costs for the project produce only a little part of the CAPEX or they might have a lack of urgency because project is not so important and critical for them when compared to their other ongoing projects. They are most probably important subcontractors and suppliers of the main suppliers and contractors.

SPs possess salience but not much ability and motivation to contribute. Their continuous involvement in the collaborative activities such as Big Room and LPS is not needed without special reason and communication between them and PTMs and KSPs can be dealt mainly without social interaction and inter-organizational meetings. They can be required to use some of the collaborative tools if it is considered useful. However, with this division the line between KSP and SP is minor because when SP gets for example, more ability and motivation to participate or more interest, it can become as important as KSPs are. For that reason, stakeholder organization should be done for the whole project and the salience and ability and motivation to contribute have to be noted from the project development until the ramp up. MEPs are not involved in the collaboration or information exchange because their involvement is not needed. However, they should not be forgotten because their contribution is needed during the project and they might have some valuable information.

4.5 Defining appropriate integration mechanisms and collaborative methods and tools for each level

In addition to Aapaoja's and Haapasalo's (2014) framework, the model includes a phase, which purpose is to help defining the appropriate integration mechanisms and collaborative methods and tools for each level. The use of different collaborative methods and tools is connected to the commercial model and contractual situation of the project because stakeholders act the way, which benefits them the most and is agreed in the contracts. Planned collaborative methods and tools to be deployed in the project should be taken into account already in the contract negotiations. The overall benefits

and stakeholders' earlier experiences about different collaborative methods and tools should be noted and used in decision about which collaborative methods and tools are implemented and used in the project. The choice about methods and tools should be done by the project customer with the help of EPCM, but the practical issues have to be discussed and agreed together with the other stakeholders especially with the PTMs. Theoretical study highlighted that the collaborative practices and socialization enhances the commitment, best-for-the-project-mindset, team working and mutual trust of stakeholders.

When choosing the right contractual, technological and organizational integration mechanisms it is important to define first the needs of the project. Needs of the project are linked into project objectives whose definition was presented in chapter 4.1.1 defining the project objectives and overall need for collaboration. For example, if one main objective of the project is to stay on schedule or conduct project faster than it is defined in initial schedule, collaborative scheduling with LPS and incentives for time savings are important. If it is defined that inter-organizational interaction in common location supports the achievement of project objectives then the Big Room is needed and if the project includes stakeholders with long distances, the virtual Big Room is needed to assist Big Room activities. However, Big Room is highly valuable for example in mutual trust building and socialization so its usage is highly recommended for all projects that are aimed to be conducted with collaborative mindset.

After defining the project needs, the means to achieve them can be set. There are numerous different integration mechanisms and related collaborative methods and tools to be chosen. Empirical study revealed that there should not be too many new tools to be learned by the project participants during the project. Some of the suitable methods are presented in table 4 and tools are presented in table 5.

Table 4. Contractual and formal integration mechanisms and mechanisms for management of people and management of the collaborative process and related collaborative methods (modified from Mitropoulos and Tatum 2000; Hietajärvi 2017a; Koskelo 2017; Haapasalo 2018).

Type of mechanism	Integration mechanism	Description	Usage requirements and recommendations for different levels
Contractual and formal integration mechanisms	Goal setting	Collaboratively agreed project goals that include the key result areas for schedule, safety, public image and usability for example.	Required for PTMs Recommended for KSPs
	Commercial incentives	Defined bonus model for key result areas.	Required for PTMs Recommended for KSPs
	Standardized project reports	Uniform method for documentation, reporting and their scheduling.	Required for all
	Project rules and plans	Mutual official rules, practices and plans including, for example collaboratively agreed decision-making structures and project goals and principles.	Required for all
Management of people	Inter-organizational team building	It includes socialization efforts for example cross-functional teams, inter-organizational meetings, collocation in Big Room and informal events.	Required for PTMs and KSPs
	Leadership	Management system that guides people in the right direction. It includes following the collaboratively agreed rules, mutual interaction, and routines, working methods and practices, coordination, assessments and support for teambuilding.	Required for all
	Involvement of project personnel	Methods to involve people in continuous improvement, for example by different innovation and initiative systems and suggestion boxes.	Required for all
Management of the collaborative process	Coordinating bodies and roles	Defining project steering and management groups and defining responsibilities for each group. Clear roles, responsibilities, and management system, which support collaboration and open communication, help to reach an efficient cooperation and open and trustful atmosphere.	Required for PTMs
	Integrative persons and facilitators	In addition to the project manager, the collaborative process is assigned, for example to collaboration and information coordinators. For example, Big Room facilitation can be assigned for certain people or roles.	Required for project customer and EPCM

Contractual and formal integration mechanisms, management of people and management of the collaborative process in table 4 can be considered to be methods that are essentially related to IPD and inter-organizational integration and collaboration. They are all important and attention should be paid on them in any project that is conducted in collaboration. Project customer together with the EPCM should take most of the responsibility for the collaborative methods and their proper use but other PTMs should be involved too.

Regarding the contractual and formal integration mechanism, PTMs should be involved in goal setting, key result areas specification for commercial incentives and project

rules, plans and project reporting format definitions. They are of course included in the bonus model. It is recommended to involve KSPs in goal setting and bonus model. All stakeholders should make project reports in a standardized way and follow project rules and plans. Regarding the management of people, PTMs and KSPs should participate in inter-organizational teambuilding including collocation in Big Room and taking part of the informal events for example. All stakeholders are required to lead their own organizations according to the projects management system and to involve their own personnel in continuous improvement by participating in innovation and initiative systems and suggestion boxes. PTMs should be involved in project's coordinating bodies and roles and they should participate in project steering and management groups. Project customer and EPCM are in responsible for nominating or hiring integrative persons and facilitators.

Table 5. Value for money thinking, management of issues and product and information management mechanisms and related collaborative tools (modified from Mitropoulos and Tatum 2000; Hietajärvi 2017a; Koskelo 2017; Haapasalo 2018).

Type of mechanism	Integration mechanism	Description	Usage requirements and recommendations for different levels
Value for money thinking	Target Value Design	Target is to design solutions and their fulfillment in collaboration in a way that the customer gets the best value for money.	Required for PTMs and KSPs Recommended for SPs
	Value Engineering	Method that supports the project lifecycle costs optimization, time savings, revenue increasing, quality improvements, market share growth, problem solving and more efficient use of resources.	Required for PTMs Recommended for KSPs and SPs
	Choosing By Advantages	Method that supports the decision-making by comparing different quality and quantitative factors' benefits.	Required for PTMs
	A3	Method for problem solving and continuous improvement that includes problem solving or solved problems information boards.	Required for PTMs
	Innovation management	Different practices and processes for developing innovations and solutions that produce value for the customer.	Required for PTMs and KSPs Recommended for SPs
Management of issues	Big Room	Common physical and/or virtual space that enables collaborative work, activities and open communication and interaction between key actors in the project. Big Room supports the creation and sharing of the project-specific knowledge.	Required for PTMs and KSPs Recommended for SPs on a case-by-case basis
	Last Planner System	The project control procedure for securing trouble-free and effective conduct of scheduled tasks.	Required for PTMs and KSPs Recommended for SPs
	Visual management	Visualization of work and workstation, which includes visual tools and methods to support and enable, for example detectability and understandability.	Required for PTMs Recommended for others
	Standardization	Aim is to define clear and coherent methods for connecting people, materials, processes, technologies and equipment for maintaining quality, efficiency, safety and evaluability.	Required for PTMs Recommended for KSPs and SPs
	Set-based Design	Method that applies concurrent engineering by studying different solutions. It enforces the actors to do detail engineering together and with modular principles.	Required for PTMs Recommended for KSPs
Product and information management	Building Information Modelling	Method for design information management, which enables consistent functional information management of building for all the project participants with a common digital system.	Required for PTMs and KSPs Recommended for SPs
	Information management Systems	In addition to building information modelling, other common systems such as project bank and communication and information practices that help to convey right information at the right time for the right person. Information must have roles such as owners, producers and users.	Required for all
	Visual and virtual tools	Use of virtual meeting tools and visual walls in meetings and in Big Room activities.	Required for PTMs Recommended for KSPs and SPs

Value for money thinking, management of issues and product and information management in table 5 include collaborative tools that are beneficial for the IPD. Their

usage requires learning and efforts from all involved stakeholders and the choice of tools must be done precisely so that the most beneficial ones for the project are chosen. It is important to note that there should be only a few new tools for stakeholders in the project because learning affects extra work and it might affect change resistance, challenges and problems.

It is important that the PTMs use all the chosen tools, for example LPS and Target Value Design, and they should be involved in choosing them. For example, they should have continuous meetings in Big Room and in practice; these meetings form the main Big Room of the project. Of course, other stakeholder levels can take part of the main Big Room meetings on request but not continually. KSPs take part of the collaboration and they should use some of the defined tools depending on the needs. It is beneficial to involve them in sub Big Rooms in their expertise areas where their ability and motivation to contribute is the highest and to involve them in scheduling of their own work areas with LPS. In addition, KSPs should use Target Value Design, Innovation Management practices, Building Information Modelling and Information Management Systems like different project banks depending on what are chosen to be used in the project. Then, there are many tools like Value Engineering, Visual Management, Standardization, Set-Based Design and visual and virtual tools that KSPs are recommended to use. The decision to use these tools depends on the project and the competencies and tasks of the stakeholders. For example, it is beneficial that KSP who has to conduct tasks related to construction should use Building Information Modelling.

SPs should participate in information exchange and use collaborative tools when project management evaluates it to be important. However, it is beneficial and required that they use common Information Management Systems such as project bank. Target Value Design, Value Engineering, Innovation Management, Big Room, LPS, Visual Management, Standardization, Building Information Modelling and visual and virtual tools are recommended for SPs. Usage requirements of these tools should be evaluated case by case. MEPs are not required to use collaborative tools other than Information Management Systems like project bank and communication and information conveying practices because they support efficient flow of information during the project.

5 CONCLUSIONS

In this chapter, the research conclusion is presented. The chapter includes the key research results and their assessment, and presentation of theoretical contribution and managerial implications. In addition, recommendations for further research are provided.

5.1 Key results

The main purpose of the research was to construct the stakeholder organization model for collaborative industrial investment projects. Research objectives were to define criteria for stakeholder evaluation and organization on different levels, involvement of different levels and what collaborative methods and tools to use at different levels. Next, the research results are presented and reviewed with the help of the three research questions.

RQ1. How to define stakeholder importance and different levels of collaboration in IPD?

The answers for the first research question are compounded from the literature. The literature review provided understanding about inter-organizational integration, stakeholder management theories and different levels of collaboration and formed a basis for the model. Inter-organizational integration and different integration mechanisms were studied because they are important in achieving the efficient collaboration and they are the means to connect different stakeholders to the same IPD. Stakeholder management theories were studied because they include different frameworks and models for analyzing and classifying stakeholders that can be used in stakeholder organization. Integration and collaboration can have different levels with different targets.

Inter-organizational integration helps to reduce uncertainty and equivocality, and especially organizational integration mechanisms help in the creation of an integrated project team. Important stakeholders should be involved early because it enhances the value creation of the project. The importance of the stakeholders means the ability to contribute and probability to impact they have and the level of impact they can make.

Ability to contribute is due to relevant competencies and information the stakeholders have and probability to impact is mainly due to their interest and motivation toward the project. The level of impact the stakeholder can make can be assessed using stakeholder salience model. Stakeholder salience consists of three attributes: power, legitimacy and urgency. The more the stakeholder has attributes the more it has salience and importance in the project. The term stakeholder is a bit problematic because stakeholders can be defined in a number of different ways. There exists narrow and broad stakeholder definitions but in this case, the narrower is better because stakeholder must has a stake or an interest towards a project so that it can be important.

The integration can have different levels within and between the projects and be different between different stakeholders. Respectively, the level of collaboration should be set according to the needs of the project and it should vary between different stakeholders with different roles and responsibilities. Stakeholders should have different requirements to participate in the collaborative process according to their organization on different levels. Achieving a high level of collaboration needs early stakeholder integration and involvement in the collaborative process, which requires resources, trust and commitment. Early involvement of key stakeholders is noted to be beneficial in complex projects with a lot of uncertainty and equivocality but when the project is simpler, there is no need for similar early involvement and close collaboration. It is important to find the right balance for stakeholder involvement to get the best benefit and cost ratio.

RQ2. Which stakeholders were important and involved?

According to the literature review, there are many models and frameworks to assess and categorize stakeholders that are important for the project to support stakeholder involvement but not from the collaboration in the industrial investment project point of view. Stakeholders that are important for the project should be involved and it can be done with the help of stakeholder identification and evaluation criteria but how early they should be involved depends on a project. Project that require unique solutions and innovations need more collaboration and stakeholder involvement than more conventional project. In addition, the phase of the project affect the form of the collaboration and stakeholder involvement because different project phases have different targets and tasks.

In the case project, there were a lot of information to be compounded and activities to be conducted and information exchange was not working optimally. In addition, project was complex by its nature and included uncertainty and equivocality. OE team noted that stakeholder involvement, socialization and joint discussions could help to improve project performance so key stakeholders including EPCM, OEMs, system suppliers, infrastructure and construction contractor and important construction subcontractor were involved and collaboration was started with them in the supplier collaboration session. All of these stakeholders had an important role in the project and they had important competencies for the project design and scheduling. It was seen that it would create the value for the project if they do project planning, scheduling, designing and engineering tasks in collaboration. Thus, stakeholder identification should focus to recognize stakeholders according to their roles and positions in the project and their competencies including valuable information and important capabilities and knowledge that are needed in the project.

RQ3. How to organize stakeholders on different levels of the model and by which collaborative methods and tools?

Stakeholders should be organized at different levels of the model based on their importance and potential to create value for the project through collaboration. Elements of the model are based on the literature review and especially to Aapaoja's and Haapasalo's (2014) framework for stakeholder identification and classification. The elements are modified according to the empirical analysis so that the model is better suitable for industrial investment projects. The model includes five elements:

- Defining the project objectives and overall need for collaboration
- Stakeholder identification
- Evaluation of stakeholder importance
- Stakeholder organization on different levels of collaboration
- Defining appropriate integration mechanisms and collaborative methods and tools for each level

The model needs element for defining project objectives and need for collaboration because needs are different in different types of projects and collaboration and stakeholder involvement should be defined according to the needs of the project. It is

essential to note what kind of interaction supports achieving the project objectives. In addition, it is important to assess the appropriate level of collaboration and the aim of the collaboration. Especially, the more there are uncertainty and equivocality in the project the more social interaction, stakeholder involvement and inter-organizational collaboration are needed.

After defining the starting point of the project, the stakeholders can be identified according to their roles, tasks, responsibilities and important information, knowledge and capabilities they possess. Stakeholders that can make the project performance better should be identified. Then, they can be evaluated and organized on different levels depending on how much they have salience and ability and motivation to contribute, in other words importance.

Aapaoja's and Haapasalo's (2014) stakeholder assessment matrix consists of stakeholder salience and ability to contribute/probability to impact assessment. Traditionally, stakeholder salience is defined to be the rate that how likely project management takes into account the stakeholder claims. However, it would be beneficial to define the salience attributes differently so that the stakeholder importance is better noted. Salience attributes should reflect the stakeholders' ability to influence project decisions, their positions in the project, responsibilities and resources they have, their capability to collaborate and their interests toward the project. Ability to contribute and probability to impact should be changed to ability and motivation to contribute because probability to impact is due to stakeholder's interest towards project and its motivation to be involved in the collaboration. Ability and motivation to contribute means the stakeholders' willingness to participate and their competencies meaning information, knowledge and capabilities they have and are needed in the project.

The most important stakeholders with high salience level and a lot of ability and motivation to contribute are PTMs and they should be in the closest collaboration level and use all the collaborative methods and tools decided to be used in the project. They should be involved in defining forms of the collaboration and in project decisions that the project customer can give to be done together with the PTMs. KSPs have less salience than PTMs but a lot of ability and motivation to contribute and they form the second level. They are involved in collaboration but not as closely and with all the same methods as PTMs are and they are not required to use all the defined collaborative tools.

SPs can have high levels of salience but they do not have much ability and motivation to contribute. They form the third level, their continuous involvement in collaboration is not needed, and communication with them can be conducted mainly without social interaction. MEPs have low level of salience and their ability and motivation to contribute is from low to high. They form the fourth level and they are not involved in collaboration but they should follow the common practices and ways of working chosen for the project meaning for example, participation on continuous improvement. It can be required that SPs use some of the collaborative tools for example LPS, Big Room and Building Information Modelling but MEPs use only common information conveying practices.

5.2 Assessing the results

The research is now assessed in terms of the internal and external validity, reliability and objectivity. According to Denzin (2009) internal validity means that how credible the research is, external validity means how easily the results can be transferred in other context, reliability means how reliable was the documentation of the research process and objectivity means that results are based on the data with sufficient certainty.

The internal validity of the research is good because the subjects of the study were convinced of the need for the model and the study takes into account the comments and answers given by the subjects of the study. The results can be transferred into other context and they can benefit for example, organizational information processing context because results can help to define what kind of information is needed in different phases of the project.

Reliability of the study is at a good level and empirical study is well described. However, observations and workshop were not audio-recorded and the data were gathered only through the notes of the researchers so the repeating of the study is hard. The study may have a lack of objectivity because the model had to be finished without empirical validation and more industrial investment projects that are conducted with collaborative practices should have been studied because there was only one case project. However, workshop included participants from different organizations and it increased the objectivity of the research. The most significant shortage of this study is the validation of the model because its functionality was not tested in practice.

5.3 Theoretical contribution

This study provided new knowledge about collaboration in industrial investment projects and presented a way to evaluate and organize stakeholders. Prior studies have highlighted the benefits of collaborative practices and there have been growing number of studies related to inter-organizational integration and collaboration in the construction project context. However, there have not been studies with similar extent in the industrial investment project context.

This research clarified the essential elements of the stakeholder involvement in the collaboration and the empirical research proved that collaborative practices could be added in industrial investment projects. Different actors in the industrial sector were willing to test new things and they saw benefits in collaborative methods. For that reason, this study presents important information about how inter-organizational integration, stakeholder early involvement and collaborative tools can benefit also the industrial projects.

5.4 Managerial implications

This study presented the model for stakeholder organization in collaborative industrial investment projects. Not many industrial investment projects have been carried out with collaborative mindset and there has been absence of instructions of which stakeholders should be involved and how. The model helps project management identify and evaluate stakeholders and organize them at the right levels. It should be used in the late development phase of the project to support stakeholder involvement in more detailed planning and design and to build mutual trust, social relationships and collaborative ways of working, which enable better teamworking and performance in project implementation. However, the model is meant to be only indicative because projects have always unique elements and challenges and successful stakeholder involvement requires understanding of the situation and the application of the contents of the model.

5.5 Future research

Stakeholder organization model for collaborative industrial investment projects is just a suggestion of how involvement can be done and it is not finally ready. More empirical

information should be gathered from several industrial investment projects to validate the performed analysis and to test how the type of the industrial project affects the exploitation of collaborative practices and the stakeholder involvement. In addition, the model should be used and validated in the projects and modified according to the results.

The literature research could have been done with the supplier perspective instead of the stakeholder perspective and it could give a different viewpoint on the phenomenon. In addition, empirical study revealed that practitioners can misunderstand the term stakeholder and think that only external stakeholders are stakeholders, and thus exclude the suppliers that are usually very important stakeholders. For these reasons, the term supplier could be used in the future research instead of the term stakeholder. The model of this study focuses mostly to stakeholder involvement but other issues related to investment projects should be studied. For example, the type of information, knowledge and capabilities that are required in early phases of the project and Lean tools that have the best cost-benefits ratio in industrial investment projects are issues that need more research.

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